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UNIVERSITY of TOKYO

No. II (1951-1952)

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I. Agriculture

Abstract Nos. 1—14

1. Studies on the fruit development in soybean. (1) Histological observation. Etsuo KAMATA (Proc. Crop. Sci. Soc. Japan **20** (3-4), 296-298, 1952)

The morphological change of fruit in the course of development in soybean has been investigated, as the fact was not yet clear in detail. "Chizuka-ibaraki No. 1", a variety of soybean, was selected as material. The plants grew in pots under the outdoor conditions and the fruits taken at one or two days' interval in the progress of fruit setting were fixed with formalin-acetic alcohol. The sections of samples were made by the paraffin and celoidin method and stained with gentian-violet.

Both the length and width of fruit increased rapidly during 9 to 21 days after blooming, but the thickness continued to grow about 41 days after the occurrence of pollination, so that the maximum of weight was seen on the 30th day in fresh and on the 36th day in dry condition. The fresh weight decreased remarkably in the ripening stage.

About 6 days were needed for the development from carpel to pod without the formation of tissues of sclenchymatous fiber, pulp and inter-epidermis, and the cells in the pod continued their enlargement during 16 days. The seed-coat originating from outer-integument completed its differentiation on the 16th day after fertilization, and its cell enlargement finished about 8 days later.

Inner-integument and nucellus degenerated by and by in the progress of embryo-formation and became invisible during 2 weeks. The differentiation of embryo which occurred on the 6th day after fertilization continued about 20 days and its cell elongation ended 5 days later. The nucleus division in endosperm was found abundantly in the early stage of fruit development, but the endosperm was gradually absorbed and pressed by the enlargement of embryo, so that the remaining was scarcely seen inside of seed-coat in the later stage. No remarkable change occurred in the tissue of funicle.

2. Studies on the development of fruit in soybean. (2) Microchemical observation. Etsuo KAMATA (Proc. Crop. Sci. Soc. Japan **20** (3-4), 299-302, 1952)

The microchemical studies have been made on the distribution of reducing sugar, starch, protein and oil produced in the fruit in the course of development in soybean. A variety, "Chizuka-ibaraki No. 1", was used as material. The plants were grown in pots under the outdoor condition, and the samples obtained every day or at a 2 days' interval were investigated with the free hand section. The methods of microchemical test used were FEHLING and FLUKIGER's test for reducing sugar, J.J-K test for starch, MILLON and BIURET's test for protein and SUDAN III test for oil.

Except the tissues of collenchyma, pulp, sclenchymatous fiber and inner-epidesmis of pod reducing sugar appeared in all the tissues of fruit in the following order of pod, seed-coat and embryo (cotyledon, radicule and plumule), and increased gradually. In the ripening stage, however, it disappeared again in all the tissues of pod and seed-coat.

Starch was detected in all the tissues of fruit except xylem of vascular bundle and lateral vein of pod during 42 days after flowering in the following order of pod, seed-coat, embryo. In the ripening stage it disappeared completely in all the parts of the fruit except palisade tissue of cotyledon and pith of hypocotyle.

Oil appeared in all the tissues of pod and seed-coat in 5-10 days after flowering and in all the parts of embryo about 10 days later. On the 48th day after flowering it disappeared in all the parts of pod and seed-coat, but it increased gradually in embryo in the progress of ripening.

A considerable amount of protein was found in all the tissues of fruit in the following order of pod, seed-coat, embryo. It increased by and by in all the parts of embryo. In the ripening stage it disappeared in all the tissues of pod and seed-coat except the residal of endosperm.

3. Studies on the effect of potassium on the rice plant. Yakichi NOGUCHI and Tomota SUGAWARA (Rpt. Inst. Agronomy, Fac. Agr., Univ. Tokyo No. 1, 1952)

The number of experiments on the nutrition of paddy rice so far carried out throughout Japan is numerous, but of the three essential elements of fertilizer, potassium is the most neglected. These studies were undertaken to fill up the knowledge of relation between potassium and plant growth in rice, especially from the physiological standpoint.

Eighteen varieties were selected as materials in the test. The seedlings, 40 or 45 days old, were cultured with soil or nutrient solution under different conditions of potassium supply. The soils used were those of potassium deficient paddy field in Niigata and Toyama prefectures.

In the progress of growth, the potash deficient plants were obviously backward in plant height and number of tillers. Their leaves turned dark green with the brown spots, occurring on the lower leaves at first and spreading to upper ones, when the want of potassium advanced. The yield of grains and straw decreased in parallel with the deficient degrees of potassium in the soil or solution. The amount of potassium in the plant increased with the increased application of potassium, but more conspicuously in stems and leaves than in grains. Nitrogen excess combined with potassium deficient. It was not only more remarkable with the increase of the quantity of nitrogen applied, but was related to the form of nitrogen. Supply of NH_4-N showed more conspicuous potassium deficiency than that of NO_3-N. The fact is thought to be partly on account of the oxidizing and reduçing electric potentials of the plant juice. The total protein decreased, on the contrary, in the state of potassium deficiency.

The quantities of chlorophyll, carotin, xanthophyll, starch in leaves decreased owing to potassium deficiency, while the total sugar increased. This is very interesting in association with the fact that potassium influences the carbon dioxide assimilation and is said to be closely relate to the formation or migration of carbohydrate. In truth, carbon dioxide assimilation decreased in the potassium deficient state, and when the supply of potassium was increased, the assimilation was found to be increased. So that the latter must be the favorable condition to the yield of rice under the lack of sunshine. The activity of carbohydrate decomposing enzymes like amilase, saccharase, etc. and oxidizing enzymes like peroxidase, oxidase, etc. in the plant was high with potassium deficient condition. It was also found, potassium application increased the thickness of culm wall, accelerated the lignification of the

wall of sclerenchymatous cell and strengthened the culm.

The results of experiment proved that, potassium was necessary throughout the whole growth period of paddy rice and if it was deficient in any part of period, the yield always decreased, but if it was given only during a certain part of the growth period and the rest left without potassium, the effects of potassium are found particularly conspicuous from one month before heading until the heading time.

4. Studies on oxygen requirement of crop roots. 1. Biochemical reduction of nitrate by roots and varietal difference. Tomota SUGAWARA (Proc. Crop. Sci. Soc. Japan **20** (1, 2), 139-144, 1951)

It has already been reported that oxygen requirement of roots in the soil varied with the difference of kind or variety of crops. The author found a close relation between reducing power and oxygen requirement of roots during the water-culture of various plants, and then cultivated young plants in a solution containing nitrate as nitrogen source and investigated the amount of nitrous acid in the solution. Soybean (12 varieties), barley (14 varieties), wheat (7 varieties), sweet potato (12 varieties), rape (14 varieties), other two or three crops and weeds were used as material in these experiments. All these plants excluding sweet potato were sown in the quartz sands until they bore one or two leaves, then the seedlings were water-cultured in the 300 cc flasks covered will blackpapers, and the plants were supported with cotton stoppers. Of sweet potato, the top of vine was cut in 15 cm and then water-cultured. The solution was changed every 3-4 days and nitrous acid in the residual solution was measured, and the total amount of nitrous acid formed during the term of water-culture (generally one month) was calculated.

The results of the experiments are as follows: Nitrous acid was not formed in the culture solutions of paddy rice, *Alopeculus aequalis*, and *Beckmannia erucaeformis*, but it was found in those of barley, wheat, soybean, corn and rape having strong reducing power in their roots. Judging from these facts upland plants generally have a strong reducing power of nitrate in the culture solution, but marsh plants have a very weak reducing power. Further, the varietal difference of nitrate reducing power was investigated with soybean, sweet potato, barley, wheat and rape, and the following results were obtained: Drought-resistant varieties form more nitrous acid than drought-susceptible varieties in the same species, but dump-resistant varieties less nitrous acid on the contrary, i. e., less reducing power, than the susceptible varieties. According to the results, it may certainly be concluded that the reducing power is closely correlated with oxygen requirement in roots, i. e., species or varieties having a stronger reducing power in their roots require more oxygen in the soil.

5. Studies on the flooding irrigation of rice plant. (2) The effects of continuous submergence on the growth and tillering of rice plant. Kanoe SATO (Proc. Crop Sci. Soc. Japan **20** (1-2), 41-45, 1951)

In the preceeding paper the author reported preliminarily on the effect of continuous submergence upon the growth and structure of rice plants. In the present studies, he intends further to ascertain the influence of continuous submergence on the growth of rice with special reference to its tillering. Therefore, the plan and the methods of investigation are similar to those of the previous year. The variety used is "Norin-ichigo", an early lowland rice. The submerged plot: The water

level of 8 cm high has been kept continuously since 2 weeks after seeding till harvest. The non-submerged plot: Soil is always moist enough with no submergence. The tendencies recognized through the results of both studies are summarized as follows.

(1) In Kanto district, the temperature of May (when the rice is seeded) is rather low, hence the submergence of water raises the temperature of earth and water surrounding rice plants, especially at night, because of its high specific heat, and promotes the growth of rice and advances the date of heading several days. But later in June the air-temperature rises fairly high, and the submergence is not so effective as in May, but becomes rather infavourable for growth of rice chiefly due to want of aeration in the soil, and the date of heading is not promoted.

(2) In the submerged plot, the number of tillers is increased in May seeded plants and decreased in June seeded ones, and the lowest tillering locus on the main stem is always moved upwards by submergence.

(3) The culm and panicle length seems to become less variable by submergence, but the grains per plant or per head may diminish in number, the reason for which is to be studied later.

(4) The form of tillering curve in rice may be analogous with that of the autocatalytic one, and each tillering curve of the first, second and third (and rarely forth) orders is its formative stuff.

6. On the leaf analysis of apples in Nagano Prefecture. Tadayoshi SUGIYAMA, Ken'ichi MIYAKAWA, Hitoo YASHIRO and Takaya OSAWA (Journ. Hort. Assoc. Japan **20** (3, 4), 191-198, 1952)

During late July and early August in 1950, leaf samples of Jonathan and Rall's Janet, the two leading varieties of apple in the Nagano Prefecture, were collected from commercial orchards, and their chemical composition was determined in order to obtain some informations about the nutritional conditions of the trees from which the samples were collected.

The content percentages of nitrogen, phosphorus and potassium in the leaves of the two varieties were as follows:

	Jonathan (121 samples)			Rall's Janet (102 samples)		
	Lowest	Highest	Mean	Lowest	Highest	Mean
N	1.91	2.79	2.34	2.30	2.98	2.59
P	0.12	0.23	0.164	0.12	0.24	0.181
K	0.69	2.14	1.35	0.76	2.33	1.37

Several factors which might affect the chemical composition of the apple leaves were elucidated.

A comparison of chemical compositions in the twenty pairs of the two varieties in which the ages of trees, cultural practices and other conditions seemed to be corresponding, revealed that N, P and K contents of Rall's Janet were significantly higher than those of Jonathan.

The age of the trees affected slightly the N and P content in Jonathan and P content in Roll's, that is, the trees the older, the contents in the leaves the less.

Potassium content in the leaves was low in Kamitakai county, and was decidedly high in Nagano City and Ina District. Twelve out of 223 samples were less than 1.0% in potassium content, most of which were found in the Kamitakai county. Phosphorus content was low in northern part of Kamitakai county, and generally high in Higashi-Chikuma county and Nagano City.

There was no correlation between the content of nutritional elements in the apple leaves and the amounts of the elements applied in the year as fertilizers.

There was no difference between the leaf composition of apples grafted on *Malus Siebolidii* (Mitsuba-kaido) stock and those grafted on *M. prunifolia* (Maruba-kaido) stock.

A positive correlation was found between nitrogen and phosphorus contents in the apple leaves of both varieties.

7. On structure of the ovary and fertilization of the Chrysanthemum. Tayzaw NIWA (Journ. Jap. Inst. Landscape Architects **15** (3, 4), 26-31, 1952)

Chrysanthemums are self-sterile. Statistical studies about this fact were reported by the author under the title of "Pollination and self-sterility of the chrysanthemum" on the Report of Japanese Association for the Advancement of Science Vol. VI in 1930.

This report describes the structure of the embryo-sac in the pistil of the chrysanthemum and the result of the investigations into the self-sterility and the cross-fertility of the plant through the observation under microscope of the state of the embryo-sac of the pistils pollinated either by themselves or by crossing to clarify the structure of the embryo-sac in the ovary of the plant.

The results obtained by this observation are as follows:

(1) The tubular florets of the chrysanthemum are proteandrous.

(2) It takes pistils 2 to 30 hours to grow over the top of the tubular florets. It takes stigmas 1 to 2 days to ripen dichotomously. The differentiation of the time of growth is caused by weather and temperature in Tokyo in the first few weeks of November.

(3) The pistil of the chrysanthemum has an anatropous ovule wrapped by integument of one lobe.

(4) By observations under microscope of the embryo-sac in the mature pistil self-pollinated in strict seclusion from pollens of other flowers (of different varieties), the author found that the embryo-sac began to wither on the 20th day after pollination, and that after more than 30 days the cells consisting of the tissues lost the turgordruck and withered completely without any symptom of fertilization.

(5) Mature stigumas grow over tops of tubular florets contract down to, or a little lower than upper rims of them in about 5 hours after cross-pollination.

(6) The following facts were obtained as the results of observations under microscope of embryo-sacs of mature pistils (of chrys.) made every 2 hours after cross-pollination.

  (a) Pollens of other flowers (of different varieties) on the mature stigma germinate easily and soon.

  (b) Pollen tubes pass inside the style, and some of them reach the micropyle as soon as 2 hours after pollination.

  (c) Within 14 to 15 hours after pollination the egg cell finish fertilization.

  (d) In 29 hours after pollination embryo with considerably mature albumen is generated.

8. Stuides on the mechanism of action of insecticides. (III) The actions of BHC and rotenone on the heart of the larva of *Allomyrina dichotomus* L. Teruo

YAMASAKI and Toshio ISHII (Oyo-kontyu 7 (1), 31-34, 1951)

By the mechanocardiographic method, using light lever, the effects of γ-BHC and rotenone on the exposed heart of the larva of *Allomyrina dichotomus* L., have been studied.

BHC (0.005 per cent) has no remarkable effects on the heart beat even after a long application.

Rotenone (0.005 per cent) brings about marked phenomena; after a treatment of 0.5-1 minute the frequency of beat is increased, while the amplitude of beat is reduced, and irregularity of beat appears. But this irregularity is not so remarkable as in the case of DDT reported in our previous paper. Increase of frequency is a transient phenomenon, for after a treatment of 10-40 minutes the frequency begins to decline, and then a level of frequency lower than that of pre-treatment stage is maintained for a long period of time. But the stoppage of beat cannot be observed even after 380 minutes. Reduced amplitude of beat is maintained during the whole experimental period. These effects of rotenone are not reversible, for, when the drug is washed out by the normal Ringer's solution even after a treatment of only 3-5 minutes, the poisoning process nevertheless proceeds.

These actions of BHC and rotenone on the insect heart have been discussed with special reference to the automaty of the heart beat.

9. Studies on the mechanism of action of insecticides. (IV) The effects of insecticides on the nerve conduction of an insects, *Allomyrina dichotomus* L. Teruo YAMASAKI and Toshio ISHII (Oyo-kontyu 7 (4), 157-164, 1952)

The effects of DDT, BHC, pyrethrine, rotenone and tetraethyl-pyrophosphate (TEPP) on the conduction of the peripheral nerve of an insect larva, *Allomyrina dichotomus* L. (Coleoptera), have been studied.

The stimulation used is a single break shock of inductorium. When a weak stimulation is applied, one compounded impulse derived from many fibers is elicited, while by a stronger stimulation more than two action potentials are induced successively.

When the nerve is treated with DDT suspension, the repetitive excitation is produced by a single shock: a train of impulses of one or several fibers lasting 0.5-1 second is elicited just after production of the normal compounded impulse. After treatment of the nerve for a longer period of time several fibers begin to discharge spontaneous impulses at random. These effects of DDT can not be removed by washing with saline.

At the first stage of pyrethrine action, a train of impulses of one or several fibers lasting 5-15 seconds is elicited just after production of the normal compounded impulse by a single shock. The repetitive activity stops soon after and is followed by a conduction block. The block is restored by washing with saline, but the repetitive activity is reproduced and continues for a long period of time.

A lower concentration of TEPP (10^{-4}) has no remarkable action on the nerve, but a higher concentration (10^{-3}) causes a conduction block. It has been shown that this block is due to hydrogen ions produced by hydrolysis of TEPP.

BHC has no remarkable action on the nerve in most cases, but small oscillations of potential may be produced by a single shock.

Rotenone has no remarkable action on the nerve in most cases, but small oscillations of potential appear spontaneously or by the stimulation.

The mechanisms of repetitive excitation under treatment with DDT and pyrethrine are discussed. Permeability of nervous membrane, some electical phenomena of the nerve, e.g., resting potential, oscillations of potential and after-potential, and acetylcholine-cholinesterase system may be important factors.

Conduction block under treatment with pyrethrine may be due not to toxicity of the pyrethrine molecule but to physico-chemical effects upon the nervous membrane.

10. Studies on xanthopterin B and leucopterin B in the silkworm. Hisao ARUGA, Narumi YOSHITAKE and Shigeo ISHIKAWA (Journ. Seric. Sci. Japan **20** (6), 399-402, 1951)

Studies on the quantitative differences between xanthopterin B and leucopterin B in the integument using normal ($+^{lem}$) and lemon(lem), yellow skin color of larva, have been done by paper chromatography. These substances were extracted with 80% methanol or 0.1% ammonia ethanol and successively spotted on a filter paper, and developed by butanol acetic in a dark room. The color of fluorescence of substances was investigated in ultra-violet light. It has been ascertained that xanthopterin B is contained abundantly in the epidermal cells of lemon larva, and excreted a little into the blood from the epidermal cells during the 4th moulting stage and large quantities of it are excreted in the faeces of matured larva. The change of leucopterin B in the epidermal cells of normal ($+^{lem}$) bears some resemblance to xanthopterin B in those of lemon, and the epidermal cells of lemon contain less leucopterin B than those of normal. Some chemical characters of the substances detected in our investigations are seen in Table 1.

Table—1. The color of fluorescence and Rf value of the substances.

	Color of fluorescence	Rf value (Butanol acetic)
Xanthopterin	Blue	0.38
Xanthopterin B	Yellowishg reen	0.40
Leucopterin	Pale blue	0.12
Leucopterin B	Purple	0.23
Riboflavine	Yellow	0.30
Kynurenine	Sky blue	0.45
3-Hydroxykynurenine	Green	0.32

11. Stuides on amino acids in the silkworm. VI. Amino acids in the mulberry leaves, eggs, larval integuments, faeces, and pupae of the silkworm. VII. Amino acids in the polyhedral body of the grasserie of the silkworm. Narumi YOSHITAKE and Hisao ARUGA (Journ. Seric. Sci. Japan **20** (4), 264-267, 1951)

The results of the qualitative studies on free amino acids in the egg, integument, blood, faece, pupa, and moth of the silkworm were reported in I-V. The present investigation is to discriminate amino acids in proteins of the mulberry leaf, egg, integument, faece, and pupa. These samples were hydrolyzed with 6N HCl for 30 hours as usual. The separation of amino acids was carried out by paper chromatography with phenol containing 0.1% ammonia, n-butanol acetic acid, and lutidine-collidine mixture saturated with water.

Amino acids in these samples are shown in the Table-1. Some amino acids not detected as free amino acids were discriminated in the hydrolysates.

Table—1. Amino acids in the silkworm.

	Mulberry leaf	Egg	Integument	Faece	Pupa	Polyhedral body of Grasserie
Phenylalanine	+	+	+	+	+	+
Leucine	+	+	+	+	+	+
Norvaline (?)	+	+	+	+	+	+
Valine	+	+	+	+	+	+
Methionine (?)	−	+	−	−	+	+
Tyrosine	+	+	+	+	+	+
Proline	+	+	+	+	+	+
Histidine	+	+	+	±	+	+
Arginine	±	±	±	±	±	±
Threonine	+	+	+	+	+	+
Alanine	+	+	+	+	+	+
Glycine	+	+	+	+	+	+
Alanylglycine (?)	+	+	+	+	+	−
Serine	+	+	+	+	+	+
Glutamic Acid	+	+	+	+	+	+
Aspartic Acid	+	+	+	+	+	+
Cystine	+	+	+	+	+	+
Cysteic Acid (?)	+	+	+	+	+	−
Glucosamine (?)	−	+	+	−	+	−
Methionine-sulfoxide (?)	−	−	−	−	+	−
Unknown spot	4	4	4	4	5	4

12. Spectrophotometric studies on some marking pigments in the silkworm. Narumi YOSHITAKE, Hisao ARUGA and Hyoichiro WATANABE (Journ. Seric. Sci. Japan **20** (6), 439-443, 1951)

The absorption spectra of some marking pigments were analysed by the spectrophotometric method with the use of normal($+^{p}$), Striped(p^{S}), Moricaud(p^{M}), Zebra(Ze), Multilunar(L), dilute black(bd), Ursa-pattern(U), Striped chocolate(p^{S}ch), and Striped Dominant chocolate(p^{S}Ia) strains.

The method of extraction is as follows: The skin which contains pigments is broken with ether in a mortar, and the residue is treated successively with aceton, methanol and normal HCl. After washing the residue with water, it is dried at 100°C and ground into powder. Normal NaOH or ethylenchrolhydrin solution of this powder is used for the measurement.

From the results of our experiments, it is plausibly said that those pigments belong to melanin and are different from ommochrome, and further that the contamination due to the imperfection of extraction has some influences on the absorption spectra.

The differences of the color in some markings seem to be due to quantitative differences rather than qualitative ones in pigments.

13. Uric acid in the integument and blood of some mutants in the silkworm. Narumi YOSHITAKE and Hisao ARUGA (Journ. Seric. Sci. Japan **21** (1), 7-14, 1952)

The authors have been studying the relations between uric acid, flavin, pterins and melanin in the silkworm on the standpoint of the physiological genetics. The results of the investigations as to the quantitative relation between uric acid and melanin pigments using several marking strains and their hybrids are as follows:

(1) The larva of Striped marking(p^S) containing much melanin pigments in the primary cuticle contains a small quantity of uric acid in the epidermis like od-translucent.

(2) In other strains of larval marking (p^M, U, L, bd), uric acid in the integuments is less than that of the respective normal segregated from the same batch as observed in the case of p^S, and the larger quantity of melanin pigments in the cuticle is, the smaller that of uric acid is.

(3) In general, uric acid in the epidermis containing melanin pigments in the corresponding cuticle is less than that of the unpigmented regions of several marking strains, and this relation is strictly intensified in Striped and Zebra markings.

(4) When Dominant chocolate(Ia), a mutant as to the color of newly hatched larva, is crossed with the above mentioned marking mutants, melanin pigments decrease, and on the other hand uric acid increases in the integuments of F_1 larvae.

(5) The comparative relations as to the quantity of uric acid in the integuments of several mutants and their hybrids are as follows:

$$p > lem > p^s > lem\ p^s > od > lem\ od > p^s\ od > lem\ p^s\ od$$

(6) There is an inverse relation between the quantity of uric acid in the blood and that in the integuments. From the above mentioned results, it is clear that there is a close relation between melanin formation and uric acid.

14. Tyrosinase activity and melanin formation of some larval markings in the silkworm. Hisao ARUGA and Shigemi KAWASE (Jap. Journ. Breeding **1** (3), 137-140, 1952)

The comparative studies have been made as to the tyrosinase activity, tyrosine, phenolic substances in the blood and integument with the use of some marking mutants to ascertain the differences of melanin formation in the silkworm larvae.

The investigation has been carried out from the 4th instar larval stage to the pupal one with the use of the strains of Striped(p^S), Zebra(Ze), Moricaud(p^M), Multilunar(L), dilute black(bd) and lemon(lem), in comparison with normal(p or $+^p$) segregated from the same batches. Warburg's manometer was used for the measurement of tyrosinase activity with Brenzcatechin and p-Cresol as the substrates.

The tyrosinase activities in the integuments of p^S, p^M, Ze, and bd were higher than those of normal before and during the moulting, and also p^S showed higher level of tyrosinase concentration than normal at the 5th age, but no significant difference was observed between L, lem and normal. On the other hand we could hardly recognize the differences of tyrosinase activity in the blood of the larvae above mentioned at every stage.

The tyrosinase activity of the integument of black pigmented region was higher than that of unpigmented one in Zebra marking during the moulting period, but its difference was not clear at the 5th age.

Tyrosine and some phenolic substances were measured with the use of the above mentioned strains by the reaction of Millon, xanthoprotein, ammoniacal silver nitrate, ferric chloride reactions. As for amino acids, the discrimination by paper partition chromatography was adopted. No differences of the quantity of chromogen have been recognized between normal and marking individuals in the blood and integument.

From these results we can conclude that one of the factors determining the difference of the formation of marking pigment is the difference of tyrosinase activity in the integument before and during the moulting period.

II. Agricultural chemistry

Abstracts Nos. 15 — 69

15. Studies on the maturing process of newly reclaimed soils. IV. Effects of calcium and bentonite on the transformation of soil humus. (part I). Kenzo KOBO (Bulletin of the Physiographical Science Research Institute, Tokyo University. **9**, 1-5, 1951)

The author investigated the effect of calcium and bentonite on the transformation of humus in soils. The wet soil and air-dried soil of Zakoji uncultivated soil which is rich in humus and poor in exchangeable calcium were used. To both was added bentonite or $CaCO_3$(ppt) with the moisture regulated at 60 per cent of the maximum water capacity, and then both were incubated at 35°C under the field condition. The transformation of soil nitrogen and the change of pH of the isoelectric point of soil were investigated and compared with the soil incubated with no material added.

The results are summarized as follows:

(1) Bentonite increased the exchange acidity of soil. The pH of the soil with $CaCO_3$ added was 8.0 ∼ 7.5.

(2) According to Dr. M. SHIOIRI, the maturing process of newly reclaimed soils are divided into three stages in relation to the change of the nitrogen latent fertility of soil. Judging from the phase of nitrogen transformation, the soil with no material added, after 194 day's incubation, was still on the phase of the first stage of the maturing process of newly reclaimed soils, and the soil with bentonite added corresponded to the second stage. The soil with $CaCO_3$ added already reached the third stage (the stage of matured soil), and particularly in the plot of air-dried soil this stage was attained after 122 day's incubation.

(3) $CaCO_3$ lowered the pH of the isoelectric point of soil. Bentonite showed a tendency to lower that point, but not as remarkably as $CaCO_3$.

From the above, it is indicated that $CaCO_3$ shows a marked effect on promoting the maturing process of newly reclaimed soils, while bentonite does not show the effect so strikingly as $CaCO_3$.

16. Physico-chemical studies on the formation of humic acids. (I). Koichi

KUMADA (Bulletin of the Physiographical Science Research Institute, Tokyo University. **9**, 6-10, 1951)

The author has studied the absorption spectra in alkaline solution, the elemental compositions and a few other properties of various kinds of humic acids, such as soil humic acids obtained from paddy soils by SIMON's method, or artificial humic acids obtained by HCl or NaOH treatment from glucose alone or in the presence of nitrogen compounds, and from lignin by HCl treatment.

The results are summarized as follows:

(1) In the form of the absorption spectra, no essential difference has been found among those humic acids, though the carbon contents and the C/N ratios were considerably different. The author, however, has not recognized any strictly proportional relation between the light absorbabilities of those humic acids and their carbon contents.

(2) The changes of the spectrometric properties of lignins after HCl treatment are analogous to the humificating process of organic matter in soils.

(3) The yield of humic substances from glucose by HCl treatment are greatly influenced by the sorts of nitrogen compounds previously added to it. From glucose and urea, it has been proved that a humic acid having any desired C/N ratio can be obtained.

17. Characteristics of fused phosphates from Kitadaito rock phosphate as revealed from X-ray diffraction examinations. Shinichiro KASUGAI, Kenjiro KIMURA, Hiroshi TAKAHASHI and Masao NAKAGAWA (Journ. Chem. Soc. Japan, Ind. Chem. Soc., **55**, 10-12, 1952)

The rock phosphate imported from Kitadaito island can hardly be converted into superphosphate because of its high sesqui-oxides contents. It has been found, however, that the Kitadaito rock phosphate shows remarkable increase in its phosphorus solubility in 2% citric acid solution when the rock is treated on the same idea as led to the manufacture of fused magnesium phosphate.

Thus, fused phosphates of several kinds were made from the Kitadaito rock phosphate in combination with basic materials such as serpentine, limestone, dolomite and calcium silicate. The ordinary rock phosphate from Angaur island or Idaho was also added in some cases. Out of those products, 11 samples distinct in chemical composition and other characteristics were examined along with their raw materials by Debye-Scherrer's method.

The results studied in comparison with both the phosphorus solubilities of the products in citric acid solution and their manurial effects shown by pot experiments are concluded as follows:

(1) The fused phosphates that show high phosphorus solubility in a 2% citric acid solution are all non-crystalline. The more crystalline the product, the less is the solubility of its phosphorus.

(2) The fused phosphates that produce high manurial effects on crops are also non-crystalline, showing, if any, the least amount of X-ray diffraction patterns (the reverse is not always true).

(3) The crystal structure of the Kitadaito rock phosphate does not remain in the products, while that of Idaho or Angaur rock phosphate—identical with that of apatite—reappears clearly in some of them as their main crystal component.

(4) No crystals inherent in dolomite, serpentine or limestone exist in the fused phosphates. Nor do their decomposed crystalline derivatives.

(5) None of iron and other pyrites, aluminous or silicious substances can be found as a crystalline mineral in the products, though the presence of both CaF_2 and $Ca(PO_4)_2H_2O$ is possible.

18. Dynamic studies on the nutrients uptake by crop plants. Part 2. The absorption, translocation and efflux of P^{32} by the root of rice seedling. Shingo MITSUI and Sueo ASO (Journ. Sci. Soil and Manure, Japan **22** (4), 297-300, 1952)

Rice seedlings were grown by the ordinary water culture technique. The roots were then divided into two parts by the root separation method; one part was dipped in the ordinary water culture solution containing $P^{32}O_4$ and the other in (a) distilled water, (2) ordinary culture solution with PO_4 and (c) ordinary culture solution without PO_4, respectively.

The radioactive phosphorous P^{32} in the form of $P^{32}O_4$ was absorbed by a half of the roots and it not only moved upward to be distributed in the stem and leaves but also it moved downward through the other half of the roots. The radioactivity of the three kinds of solution in which the other half of the roots were immersed was assayed by the Lauritsen electroscope from day to day.

The apparent "excretion" was insignificant in 48 hours in each plot followed by the remarkable increase in the "distilled water" plot in 96 hours. The difference between the two plots, "water culture solution with PO_4" and "water culture solution without PO_4", was insignificant and remained within experimental error; the fact indicating no possible excretion by the "exchange" between the P^{32} held in the root protoplasm and the non-radioactive P in the solution. Moreover, the greater "excretion" of P^{32} in the "distilled water" plot seems to support its exudative nature as contrasted to the exchange reaction definitely established in the cation excretion.

The absorbing roots and excreting roots were divided into three parts respectively and assayed for the radioactivity.

The result was that the general trend of P^{32} distribution was the same for the two roots and for each plot, although the amount distributed in the old excreting was from about half to one third of the old absorbing one.

This suggests that P^{32} can move downward to the root simultaneously with the upward movement of not only water and other salts but also even of PO_4.

19. Dynamic studies on the nutrients uptake by crop plants. Part 3. The reducing power of the roots of growing plants as revealed by nitrite formation in the nutrient solution. Shingo MITSUI and Kiyoshi TENSHO (Journ. Sci. Soil and Manure, Japan **22** (4), 301-307, 1952)

In the course of some dynamic studies on the nutrient uptake by crop plants the reducing power of the roots of growing plants as revealed by nitrite formation in the nutrient solution was determined through the whole periods of growth.

The results may be summarized as follows.

1. The accumulation of nitrite nitrogen by seedling of crop plants increased gradually as the days passed, although the amount was in general scarce and for lowland rice and taro it was 0 ~ trace indicating some oxidative power of their roots in contrast to other crops.

2. The general trend of nitrite formation of 13 kinds of crop through their

complete growth periods was as follows.

For cereals such as lowland rice, upland rice, corn, kaoliang, wheat, barley and rye it began to increase about one month before shooting (period of elongation), attained its maximum at flowering or shooting and was followed by a gradual or sudden decrease till the maturing stage.

The lowland rice, one of the typical aquatic plant, was by no means an exception. Rape showed a trend similar to cereals, but the maximum was attained far after the flowering stage. Taro, which is said to prefer nearly aquatic soil humidity and which usually reproduces without flowering, behaved peculiarly, the feeble nitrite formation gradually increasing without any peak until its harvest time was reached.

3. The result was discussed from the agronomical viewpoint, for instance, the possible contribution of the reducing power of the roots of lowland rice and wheat and barley at their vigorous growth to the enhanced injury done by hydrogen sulfide and by the too high water level respectively. Moreover, the increasing phosphate absorption during the spring time by various winter cereals, a fact known to fertiliser experiments, might be partially explained by the increasing reducing power of the roots of the cereals at this period, meaning the partial reduction of ferric to ferrous—the increase in phosphate solubility—in the rhizosphere.

20. Studies on the amino acids and amides metabolism of rice plant. (part 1). Kiyoshi OZAKI and Masaaki MORIYAMA (Journ. Sci. Soil and Manure, Japan **22**, 323, 1952)

The role of acid amides is one of the most important problem in nitrogen metabolism of higher plants.

The amides in rice plant have been recognized as very important substances, especially with respect to the abundant supply of ammonium nitrogen and to rice blast, but have not yet received full investigation.

In 1951, the authors tried a preliminary experiment on the metabolism of free amino acids and amides in the growing rice panicles by means of paper partition chromatography, and drew attention to the fact that glutamine was always present at any growing stage of the panicle, while asparagine was to be found only at a later stage, that is, just before shooting. This would suggest a special metabolic significance of asparagine as compared with glutamine.

In 1952, a more detailed study was carried out concerning the behaviour of these two amides through the whole growth period of the rice plant and with various nitrogen sources.

There was a distinct difference between the appearance of glutamine and asparagine. Glutamine was detectable in every organ through the whole growth period with any nitrogen source including no nitrogen, whereas asparagine was absent in the no nitrogen plot during the earlier growth stage and then made a distinct appearance in the panicle before shooting.

The unexceptional appearance of glutamine may suggest that this amide might possibly be linked in some fundamental nitrogen metabolism of the rice plant. As for asparagine it is difficult to decide whether it is linked with some particular metabolism of the panicle or whether it is merely the result of the accentuation of the physiological drift from vegetative to reproductive growth. This requires further study.

21. Studies on the enzymic formation and degradation of starch. IX. On the mechanism of the action of amylosynthease. Bunji MARUO, Tsuneo KOBAYASHI and Yutaka TSUKANO (Journ. Agr. Chem. Soc. Japan **25**, 34-7, 1951)

The mechanism of action was examined on the amylosynthease. The enzymic activity was not affected by the presence or absence of inorganic phosphate, showing that the enzyme was not of the phosphorylase type. No dialyzable or easily dissociable co-factor was associated with the enzyme activity. The enzyme showed no hydrolytic action on bacterial dextrans produced from sucrose by *Leuconostoc mesenteroides*.

Dextrins with red iodine-color were prepared from potato amylose and amylopectin, respectively, by means of malt α-amylase. When the amylosynthease was allowed to act on these dextrins, only the dextrin from amylopectin could be converted into products showing blue iodine-color. The fact indicated that the presence of branching points at α-1,6-glucosidic linkages in the substrate was necessary for this enzyme to develop its action.

Several conceivable processes were discussed with reference to the enzyme action. But the theory formerly proposed by the authors was again confirmed; the enzyme attacks the points of branching in the glucosidic chains (α-1,6-glucosidic linkages), and produces amylose-like substances. All experimental evidences hitherto observed can be explained rasonably by this scheme.

In conclusion, this enzyme is considered as an amylase of a particular type, having the action of hydrolyzine amylopectin-type polysaccharides at the points of branching of glucosidic chains. A new name "Isoamylase" is proposed for this enzyme, instead of the old, misleading name, "amylosynthease".

X. The distribution of phosphorylase, phosphatase, and β-amylase in palnts. (4) The distribution in fruits, vegetables, and leaves. Michinori NAKAMURA, Kyôji YAMASAKI and Hisaaki TODA (Ibid. 119-21)

The distribution of phosphorylase, phosphatase, and β-amylase in fruits, vegetables (except root vegetables), and some leaves was examined. Fruits contained little or no enzyme activities, but chestnut and gingko, which contained large amounts of starch, were rich in phosphorylase activities. Chestnut was also active in phosphatase. Almost all vegetables and leaves, except onion, showed more or less phosphorylase and phosphatase activities and little or no β-amylase activities. Pumpkin, and leaves of potato and some *Brassica* species were especially active in phosphorylase. It was suggested that phosphorylase might take part in the formation of assimilation starch as well as reserve starch in plants.

XI. Mechanism of formation of starch in the leaves of higher plants. (1). Bunji MARUO and Michinori NAKAMURA (Ibid. 245-8)

Comparison was made on the starch formation in leaves from various sugars and glucose-1-phosphate. Leaves were detached from the plant, kept in the dark for 24-48 hours with their stems immersed in water so as to consume the starch already present in the leaves, and the discs were cut from these leaves. These leaf discs were floated in the dark on water containing various sugars to be tested. After 24-48 hours, the leaf discs were boiled with water, then with alcohol so as to remove the chlorophyll, and then tested with iodine solution for the formation of starch from the sugars. Among various sugars tested, sucrose, maltose, glucose,

fructose, and galactose were excellent materials for starch formation. No starch formation was observed from mannose, arabinose, and rhamnose. When air was replaced by H_2, H_2S, or CO_2, or when toluene, thymol, ether, chloroform, KCN, NaF, $HgCl_2$ were added to sugar solutions, no starch formation was observed. Sinking leaf discs or leaf homogenates did not form starch from sugars. Under similar conditions (except in the presence of $HgCl_2$), starch was formed from glucose-l-phosphate. The effects of pH and concentrations of salts of the solution were tested. It was found that the formation of starch was not significantly affected between pH values of 5.8-7.7. Greater concentrations of salts had a markedly inhibiting effect on the formation of starch. It was suggested that starch formation from sugars must be coupled with respiration and the energy necessary for the phosphorylation reaction of sugars would be obtained from the coupled respiration in leaves.

XII. The distribution of phosphorylase, phosphatase, and β-amylase in plants. (5) The distribution of them in cereals, and in samples with high β-amylase activities. Michinori NAKAMURA and Hisaaki TODA (Ibid. 248-52)

Phosphorylase and phosphatase were widely distributed in cereals without great differences in their activities. The distribution of β-amylase showed considerable differences among various kinds of cereals and high enzyme activities were found in wheat, barley, and rye. Phosphorylase activities in samples with high β-amylase activities were reexamined by the $HgCl_2$ method described in another place (cf. ibid **24**, 197, 299, 1951). Sweet potato, kuwai, water cress, and soybean, which were very active in β-amylase, were also active in phosphorylase and phosphatase. Twelve strains of sweet potatoes, cultivated under the identical conditions, were examined for the above 3 enzyme activities. Significant differences were observed among strains.

XIII. Phosphorylase of sweet potato. Michinori NAKAMURA (Ibid. 413-17, 1952)

Sweet potato phosphorylase was purified by the repeated ammonium sulfate precipitation method. The most purified preparation thus far obtained was 13 times as active per mg. protein as the original extract, although it still contained a small amount of β-amylase. The dissociation constant between the enzyme and substrate (i. e. the Michaelis constant), as determined by the graphical method of LINEWEAVER and BURK, was $2.5 \times 10^{-3}\ M$ glucose-l-phosphate. This purified sweet potato phophorylase required added primer for the synthesis of starch from glucose-l-phosphate. This is in contrast to the discovery of INOUE, *et al* (cited from ONODERA; in NIKUNI (Ed.), Starch Chemistry 448, 1951) that purified sweet potato phosphorylase requires no added primer in the synthesis of starch. Temperature coefficient of this enzymatic reaction between 17-42° was about 2, with apparent activation energy of about 13,000 cal. Optimum pH of this enzyme was about 5.8, but no significant differences in the enzymatic activities were encountered within pH values of 5.6-6.8. Equilibrium of this reaction was obtained when the value, free P/(free P + ester P), reached 85-89%. The equilibrium constant of this reaction, K = 5.7-8.0, and the change in the free energy, $-\Delta F = 1{,}000\text{-}1{,}400$ cal., were calculated from the above data.

22. Studies on dextran. I. The preparation and properties of dextran. Tsuneo KOBAYASHI and Yutaka TSUKANO (Journ. Agr. Chem. Soc. Japan **25**, 421-3, 1951-52)

Bacterial dextran was prepared from sucrose by a strain of *Leuconostoc mesenteroides*. The method of preparation and the properties of the products were described. The mean molecular weights of several preparations were determined by measuring the osmotic pressure of aqueous solutions at 30°C, with the apparatus of BULL and CURRIE. The values ranging from 50,000 to 150,000 were obtained. The mean molecular weights (M) were found to be in a linear relationship with the intrinsic viscosities ($[\eta]$). Thus, the STAUDINGER's viscosity law held approximately, the K_m constant being ca. 1.0×10^{-4}. The following experimental equation was derived from $[\eta]$ and M: $[\eta] = 0.13 + 4.6 \times 10^{-6} M$. But this equation could be applied only on products of the same strain; products by different strains of the organism have different viscosity-molecular weight relations.

Dextran was not attacked by α-amylase, β-amylase, nor by isoamylase. It did not activate the potato phosphorylase in the starch synthesis, showing a discrepancy with the results obtained by several other authors. It was suggested that the products by various strains differ considerably in their molecular sizes and chemical constitutions.

23. Studies on dextran. II. On the velocity of acid hydrolysis. Tsuneo KOBAYASHI and Yutaka TSUKANO (Journ. Agr. Chem. Soc. Japan **25**, 424-6, 1951-52)

A comparison of the velocities of acid hydrolysis of dextran and starch-type polysaccharides was made in order that fundamental data may be obtained on the properties of α-1,4- and α-1,6-glucosidic linkages. The experiments were carried out in 10 N sulfuric acid at 40°, 50°, and 60°C, and the degree of hydrolysis was followed by reducing power measurement. The velocity constant of hydrolysis, calculated as a unimolecular reaction, was about 10 times as large for amylose as for dextran at 40°C, and about 6 times at 60°C. The activation energy of hydrolysis was calculated to be 27 000 cal. per mole for amylose, and 32 300 cal. per mole for dextran. It was concluded that α-1,6-glucosidic linkages were considerably more stable than α-1,4-glucosidic linkages.

24. Studies on chemical reactions by a high frequency oscillator. I. Application to the micro-KJELDAHL method. Tetsurô KÔNO (Journ. Agr. Chem. Soc. Japan **25**, 567-70, 1952)

A new Colpitts type oscillator for chemical analysis was designed. The cell was inset in the condenser, the grid bias was measured with a valve volt meter, and the frequency used was 14 MC. The instrument had enough stability for usual titrations. The titration curve by 0.01 N NaOH did not give a straight line, as pointed out before, because of the effect of dissolved CO_2. But the end point could be read exactly when 0.01 N Na_2CO_3 was used instead of NaOH, for the former gave straight lines on both sides of the end point on the graph. As the end point by this method was neither affected by CO_2 nor by NH_4Cl, the method was applied to the micro-KJELDAHL method satisfactorily.

II. Explanations of the curves and titration curves of glycine. (Ibid. **26**, 41-5, 1952)

The change of the grid bias of the oscillator and the conductivity of the solution were roughly proportional in dilute solutions. Bearing it in mind, the author examined various titration curves. An accurate end point could not be obtained

when acetic acid was titrated by 0.01 N NaOH and *vice versa*. But the end point was clearly determined when NH_4OH was titrated by 0.01 N HCl and *vice versa*. Glycine was titrated, the curve by HCl did not show any breaking point, but that by NaOH gave it, though it was not so distinct as can be useful for quantitative work.

25. Application of an oscillator for the study of enzymatic reactions. Tetsurô KONO (Symposia on Enzyme Chem. Japan 7, 62-4, 1952)

The reaction of urease was studied with the use of the oscillator. The formation of $(NH_4)_2CO_3$ from $(NH_2)_2CO$ was traced just after the mining of the components. No special initial reaction was observed. The well known activation and and inactivation of the enzyme by reagents were clearly shown by this method. The product was titrated by 0.01 N HCl with the same high frequency instrument.

26. Non-growth promoting activity of vaccenic acid. Akihiko NAKAYAMA (Journ. Jap. Soc. Food and Nutrition 4, 178, 1952)

Vaccenic acid prepared from Chinese wood oil had no activity when tested with white rats.

27. On the microdetermination of sulfhydryl group in denaturated proteins. Yoshikazu SAHASHI and Hideo SHIBASAKI (Journ. Agr. Chem. Soc. Japan **25**, 57, 1951)

In 1941 it was reported by O. ZIMA that the sulfhydryl group in cysteine or glutathione can be determined by treating them with thiamine disulfide and then by estimating micro-amount (0.2-0.5 γ) of thiamine in the resultant solution by the thiochrome method. Recently the authors have carried out a few micro SH group determinations in denaturated proteins by this method. The results are briefly summarized as follows:

(1) The estimation of the SH group in egg-albumin denaturated by urea was successful.

(2) But, on the other hand, no accurate results were obtained in experiments with egg-albumin denaturated by guanidine hydrochloride.

28. Bleaching of wheat-flour in the baking-process by lipoxidase and its solution to destruction of vitamin B_1 and B_2. Yoshikazu SAHASHI and Hiroyasu FUKUBA (Vitamins 4, 204, 1951)

Lipoxidase in soybean, both fresh and powdered, is the most favourable for bleaching of wheat-flour in baking-process (loss of B_1 is 6-7%, that of B_2 is 0).

29. Biochemical studies on vitamin B_{12} (continued). Yoshikazu SAHASHI, Masayuki MIKATA and Heiichi SAKAI (Vitamins 4, 203, 1951)

In the study of vitamin B_{12} biosynthesis by chick liver paste, production of P^{32}-labelled B_{12} was investigated by the methods including radioautographic technique.

30. Biochemical studies on vitamin B_{12} (continued). Studies on "Kuwazu Disease" in Shiga Prefecture (1). Yoshikazu SAHASHI and Kiichi IWAMOTO (Vitamins 4, 211, 1951)

The cause of "Kuwazu Disease" was found to be B_{12} defficiency following the death of Actinomyces in rumen. Water containing SiF_6'' in this district indicated a toxic effect against the production of B_{12} by Actinomyces.

31. Biochemical studies on vitamin B_2 (continued). Yoshikazu SAHASHI,

Kiichi IWAMOTO, Masayuki MIKATA, Heiichi SAKAI and Yoshitada TAKINO (Vitamins **4**, 323, 1951)

(1) Estimation of B_{12} were investigated further by:
G.E. Recording Spectrophotometer
BECKMAN Quartz Spectrophotometer
Microbial Assay (*Lactobacillus leichmannii, Euglena gracilis*)

(2) Bactericidal action of SiF_6'', supposed to cause "Kuwazu Disease", was found stronger than that of F' (1.5-2.0 mg/10 cc. Na_2SiF_6 is lethal for Actinomyces.)

32. Biochemical studies on vitamin B_{12} (continue). Oral administration of Actinomyces to chicks. (Preliminary Report). Yoshikazu SAHASHI (Vitamins **4**, 378, 1951)

Body weight gains of chicks, administered with Actinomyces PD-61 (producing 13000 L.L.D. unit per cc.) per os and B_{12} devoid diet, were 20% more than the control group.

33. Biochemical studies on vitamin B_{12} (continued). The relationship of $H_3P^{32}O_4$ to B_{12}. Yoshikazu SAHASHI, Masayuki MIKATA, Heiichi SAKAI and Hiroshi NAITÔ (Vitamins **4**, 389, 1951)

P^{32} uptake into B_{12} DNA, and RNA by Actinomyces PD-61 was investigated with bioautography, radioautography and color reaction of P.

34. Biochemical studies on vitamin B_{12} (continued). Yoshikazu SAHASHI, Kiichi IWAMOTO and Heiichi SAKAI (Vitamins **4**, 456, 1951)

The existence of B_{12}-producing microörganisms (Actinomyces) in the chicks' alimentary canals was investigated. From proventriculus and intestines of chicks, administered daily with B_{12}-producing Actinomyces per os, no Actinomyces was found. From gizzards of ordinary chicks, too, no Actinomyces was obtained. This result seemed to be consistent with the requirement of B_{12} for the normal growth of chicks.

35. Biochemical studies on vitamin B_{12} (continued). On the estimation of vitamin B_{12} with *Euglena*. (Preliminary Report). Yoshikazu SAHASHI, Masayuki MIKATA and Hiroshi NAITÔ (Vitamins **5**, 252, 1951)

By the statistical calculation, it was found that the standard curve in *Englena* method was represented by the equation $Y = a + bX$. In this equation, a and b were constants, Y was logarithm of concentration of B_{12}(mγ/cc.) and X was turbidity. In the experiment, the range of optimum B_{12} concentration was 0.001-0.010 mγ /cc.

36. Biochemical studies on vitamin B_{12} (continued). Investigation of the B_{12}-potency in the B_{12}-injectable solution with *Euglena*. Yoshikazu SAHASHI and Masayuki MIKATA (Vitamins **5**, 252, 1951)

37. Biochemical studies on vitamin B_{12} (continued). "Kuwazu Disease" of cows and B_{12}-producing microörganisms. Yoshikazu SAHASHI and Kiichi IWAMOTO (Vitamins **5**, 252, 1951)

In feces of cows, suffering from "Kuiyami Disease" seen in the district where Co^{++} content was poor or from "Kuwazu Disease", no B_{12}-producing microbe, mainly Actinomyces, was found.

From the results, it was found that the Co starvation as well as the presence of fluoride (reported previously) in soil affect the B_{12} nutrition.

38. Preparation and pyrolysis of kitol (I-V). Yoshikazu SAHASHI, Akihiko NAKAYAMA, Toshio MUTO, Masayuki MIKATA, Shirô MATSUMOTO, Akira TERAKAWA, Toshitaka KAKUDA and Hideyo SUZUKI (Vitamins **5**, 254, 1952)

Preparation of kitol from various whale liver oil samples was studied. One mole of vitamin A was obtained from 1 mole of kitol by means of molecular distillation.

39. On the protein precipitant for the determination of true protein in foods and fodders. Makoto KANDATSU and Tadahiko YASUI (Journ. Agr. Chem. Soc. Japan **25**, 27, 1951)

We designed to study the relation among the results obtained by BARNSTEIN's method, the trichloroacetic acid method and the perchloric acid method for the determination of true protein in foods and fodders. Our results indicate that (1) BARNSTEIN's reagent precipitates some non-proteinous nitrogen compounds in foods and fodders, especially in hay and rice bran, and so it is not suitable for the purpose, (2) the trichloroacetic acid method is the best of the three, and we should use the 5-10% CCl_3COOH solutions and wash the precipitation by the same solution, and (3) the perchloric acid method is generally not applicable in the protein determinations of foods and fodders.

40. Biochemical studies on the formation of muscle protein. Part I. Amino acid content of muscle protein of tryptophan-deficient rats. Makoto KANDATSU and Syujiro ARIYOSHI (Journ. Agr. Chem. Soc. Japan **25**, 240, 1951)

(1) The amino acid content of muscle protein prepared from protein-deficient rats and tryptophan-deficient rats was determined.

(2) The tryptophan content of muscle protein was lower in tryptophan-deficient rats than in protein-deficient rats, and it was lower in protein-deficient rats than in control animals.

(3) Diamino acids: monoamino acid ratio and lysine content of muscle protein were lower in protein-deficient rats than in tryptophan-deficient rats, and they were lower in tryptophan-deficient rats than in control animals.

(4) Tyrosine and histidine contents of muscle protein were lower in protein-deficient rats than in the control. The protein deficiency affected the muscle protein of rats in the same manner as stated by A. ROCHE.

41. Studies on the nutritive value of grass proteins. Part I. On the isolation of proteins from leaves of red clover and orchard grass. Makoto KANDATSU and Hiroshi NISHI (Journ. Agr. Chem. Soc. Japan **25**, 562, 1952)

By extracting with various solvents the nitrogen distribution of red clover and orchard grass has been determined, and proteins from these leaves have been isolated. Results obtained are as follows:

(1) 70-80% of leaf proteins is extractable by treating successively with dilute alkali and hot alcoholic dilute alkali.

(2) Dilute alkali and hot alcoholic alkali soluble proteins have been isolated respectively, showing nitrogen contents ranging from 8.94 to 12.03%, or 13-14% on ash- and lipoid-free basis.

(3) Pentosan and hemicellulose were scarcely detected in our protein preparations, so most of the non-protein constituents must be other materials. Nitrogen contents of both proteins cannot be increased by ordinary methods, that is, reprecipitation with acid and ammonium sulfate, boiling with dilute alkali and hydrochloric acid.

(4) Alkali-soluble protein from red clover was hydrolysed with concentrated hydrochloric acid and its nitrogen distribution was determined by Van SLYKE's method.

(5) Acid-insoluble humin substance contains 3.17% nitrogen and yields 27.5% from proteins by the above acid hydrolisis. It is soluble in 0.2% NaOH, hot acid benzyl alcohol and contains the methoxyl group.

42. Studies on the relation of formol reaction of fish meat with its freshness. Rinjiro SASAKI and Masao FUJIMAKI (Journ. Agr. Soc. Japan **24**, 452-455, 1951)

When a neutralized formalin solution was added to an aqueous extract of tunny meat, it was observed that the solution turned from clear to turbid and then became coagulative as the freshness of the meat decreased. The coagulative precipitation in formol reaction of fish meat was observed at the beginning point of putrefaction, nearly parallel with the increase in pH value (about 6.3) and volatile basic nitrogen (26-28mg%).

The same changes were observed between spoiled meat and aqueous extract of fresh meat.

Reversely, when the dilute alkali extract of fresh meat, or aqueous extract of spoiled meat was acidified with HCl (below pH 6.3), the coagulative precipitation disappeared.

Then we believe that it may be possible to use this reaction for determining the freshness of fish meat such as tunny.

43. Studies on lactose as an infant food. Rinjiro SASAKI, Michiyo KONDO, Shizuo MORISHIGE and Tadahisa SATO (Journ. Jap. Soc. Food and Nutrition **5**, 99-104, 1952)

(1) Commercial lactose was refined, and lactose was proved to be pure α-lactose monohydrate by its specific rotation and water of crystallization.

(2) With modified milk i.e. refined lactose added to cow's milk, feeding experiments for infants were performed. It was observed that refined lactose sometimes gave diarrhoea to infants.

(3) Effect of time and temperature on the ratio of α-form and β-form was made clear when the refined lactose was dissolved in water. Further feeding experiments were carried out, paying especial attention to the ratio of α-form and β-form at the time of the feeding. It was found out that in case the rate of α- and β-lactose were in equilibrium the lactose did not cause diarrhoea, and in case α-lactose monohydrate was in excess, the lactose sometimes caused diarrhoea.

(4) In both mother's milk and cow's milk, α- and β-lactose have proved to be in the rate of equilibrium.

44. Changes in milk protein caused by heat. Tomikichi TSUGO (Sci. Animal Products **3**, 139-144, 1952)

Changes in milk protein during the heating of milk had been studied by means

of formol titration, the increase of digestible nitrogen with pepsin, the coagulation time with rennet and the effect of adition of solublec calcium salt. The results showed that the values of formol titration and digestible nitrogen with pepsin hardly varied up to 60°C, but they slightly increased above 80°C, and appreciably at 120°C. The property of rennet coagulation of milk (coagulability of casein) was affected remarkably by heat-treatment, and by 30 minutes of heating, the coagulation time was prolonged about double at 70°C, about four times at 80°C, about six times at 90°C and more than six times at 100°C, as compared with raw milk. However, at the temperature below 80°C, it seemed that these changes could be attributed to indirect influences due to the decrease of soluble calcium in milk by the heat-treatment.

45. Statistical studies on the comparison of the methods of fat determination in milk, non-fat milk and cream. Tomokichi TSUGO and Hironobu TAGUCHI (The Dairy Times **12**, (9), 6-9, 1952)

Concerning the fat determination in milk, non-fat milk and cream, experiments were made to compare the ROESE-GOTTLIEBE method (as a standard method) with various simple methods such as the BABCOCK method, the GERBER method, the Minnesota method and their modifications, and the results were discussed statistically.

(1) As to milk, both the BABCOCK method and the GERBER method showed no noticeable difference from the ROESE-GOTTLIEB method. However the BABCOCK method seemed to show a noticeable difference when the contents of fat in milk were comparatively high (more than 3.3%).

(2) As to non-fat milk, the BABCOCK method, the Minnesota method and the new Minnesota method all showed noticeable difference from the standard method. These simple methods showed much lower values than the standard method, and the difference was most noticeable in the new Minnesota method, and comparatively small in the BABCOCK method.

(3) As to cream, the BABCOCK method showed a noticeable difference from the standard method. And the higher the fat percentage is, the greater the difference. A modification of the GERBER method in which the cream is diluted showed no noticeable difference from the standard method. However, a noticeable difference seemed to exist when the fat percentage in the cream became higher.

46. Biochemistry of "Bakanae Fungus". Part 23-24. The chemical constitution of Gibberellin. IV-V. Teijiro YABUTA, Yusuke SUMIKI and Kiyoshi ASO; Michihiko YATAZAWA and Yusuke SUMIKI (Journ. Agr. Chem. Soc. Japan **25**, 159, 503, 1951)

In the previous papers concerning the structure of gibberic acid, $C_{19}H_{22}O_3$, one of the acid degradation products of gibberellin, the following 4 points were emphasized. 1) The function of 3 oxygen atoms was found to be one ketone and one carboxyl. 2) The parent nucleus must be fluorene. 3) The 2 side chains of the gibberic acid might be attached to the 4th and 5th carbon atoms of fluorene nucleus. 4) The nucleus should be hydrated partially. In the present paper, the oxidative results of gibberic acid with MnO_2 and SeO_2 were given.

By treating gibberic acid with MnO_2, the hemimellitic acid, mp. 191-2°, prisms, was obtained. From this result, it was proved that the position of one side chain attached to the parent nucleus, i.e. fluorene, must be the 5th carbon atom of fluorene

and the parent nucleus must have a benzene ring fused to the partially hydrated indane system.

By the oxidation of SeO_2, gibberic acid gave birth to a substance, $C_{19}H_{22}O_4$, mp. 188°, yellowish plates, named gibberdionic acid. Gibberdionic acid showed an ultraviolet absorption spectrum very similar to that of gibberic acid. This fact indicated that there occurred no change in the parent nucleus of gibberic acid but an oxidation in one side chain introducing a new carbonyl group upon the position of the next carbon atom of the ketone group which existed originally. Gibberdionic acid reacted negatively towards diketone's reagents, while glyoxal's tests were positive. Further, by treating gibberdionic acid with H_2O_2, we obtained one mole each of a hydroxy-dicarboxylic acid and CO_2 but no volatile-carbonyl compound and acid. From these facts, it was proved that the position of the original ketone group in gibberic acid is located not in the parent nucleus but in one of the side chains, and moreover that it is adjacent to the terminal methyl group of its side chain.

47. Studies of "Fungisporin". part 1. Yusuke SUMIKI and Kohei MIYAO (Journ. Agr. Chem. Soc. Japan **26**, 27, 1952)

A new compound was obtained as the crystalline sublimate by destructive distillation from several species of Penicillium and Aspergillus.

It was ascertained that this substance was one of the components of their spores and not the product formed secondarily by the destructive distillation. We named the substance "fungisporin". It was found that fungisporin consisted of C, H, N and O, having a decomposition pt. 355-60°. $(C_{13}H_{16}O_2N_2)_x$ was proposed as the experimental formula of fungisporin. The fungisporin was not soluble in the majority of solvents, both organic and inorganic, and therefore, its alkyl and aloyl derivatives could not be prepared.

By treating with a conc. soln. of HNO_3, it gave forth a p-nitrobenzoic acid and a crystalline substance mp. 132-5°, containing N.

By treating with a conc. soln. of HCl, it gave forth an amine, having an experimental formula $C_8H_{13}O_2N$. The function of this amine is identified as the primary amine.

The absorption spectrum of infrared ray showed the existence of the following groups such as $-OH$, or $=NH$, $-CH=CH-$, $-CONH_2$, $-CH_2$, and $-CH_3$. From these results, we assume that the fungisporin is a high molecular substance somewhat similar to a simple protein.

48. Microbiological studies of penicillin production. VI. Studies on sporulation media. Kei ARIMA, Kosaku TANAKA and Kotaro MASUDA (Journ. Antibiotics **III-8**, 493, 1951)

The effects of various inorganic salts, sugars, organic and inorganic nitrogenous compounds and natural substances on the sporulation medium of penicillin production, and a simple cup method for testing the effectiveness of these substances were studied.

Cu ion increased the sporulation markedly, and Co, Ba, Ca, Mg, Zn, Al ions were also considerably effective. Ash of woods were quite effective too. Among various sugars inulin was the most effective, and follows glucose, starch and sucrose in this order. Among natural substances, carrot, potato, sweet potato, jerusalem

artichoke, wheat bran, rice bran were as effective as Cu ion. By the use of these sporulation media, for instance CZAPECK + $CuSO_4$, a slant culture in ordinary test tube contained about 70-80 millions of spores, while control CZAPECK agar slant culture produced only about 40 millions of spores. One gram of wheat bran culture contained about 300 millions of spores.

On investigation of the cultures of at least four successive transfers on these sporulation media, the authors could not recognize any increase in the mutation ratio or the run down of penicillin productivity. In such cultures the number of spores were two or three times of those of ordinary CZAPECK solution agar slant culture.

The sporulation of every mutant type strains of Q 176 including the pigmentless saltant on these media were tested and almost the same sporulation as above were obtained.

49. Microbiological studies of penicillin production. VII. The artificial mutaltion of penicillin producing molds; Ultraviolet ray induced mutations in *Penicilium*. Kei ARIMA (Journ. Antibiotics **IV-4**, 232, 1952)

The effects of ultraviolet ray upon *Penicillium*, mainly *Penicillium chrysogenum* Q 176 were studied and the following results were obtained.

The survival curves and the mutation curves of ultraviolet ray irradiated spores of this mold were examined, and a straight line relationship between the dose of ultraviolet ray and the logarithms of survival rate or mutation rate were reocgnized. By an irradiation for 7-10 minutes at a distance of 50 cm from the lamp, killing rates of 99.0-99.9% and mutation rates of 60-70% were obtained.

The types of the mutants which were induced by ultraviolet ray irradiation could be classified morphologically into several types: i.e. the heavy type, the light type, the albino type, the yeast type, the pigmentless type, similar to the mutant types in the case of spontaneous variation. Mutation rates were remarkably increased by irradiation. But any definite relation between the dose of ultraviolet ray and the occurrence of any one specific type of mutant were not recognized.

Thus the general effects of ultraviolet irradiation on this mold seemed to be the induction of various types of mutants which are degenerative and regressive in morphological and penicillin producing properties.

The germinated spores of this mold were less resistant to ultraviolet ray than spores, and the dry spores were more resistant than the wet spores. Differences in the resistances to ultraviolet ray could be also recognized among strains.

A general review of the recent literatures on the effects of ultraviolet ray upon microbes was given.

50. Microbiological studies of penicillin production. VIII. The artificial mutation of penicillin production molds; X ray induced mutations in *Penicillium*. Kei ARIMA (Journ. Antibiotics **IV-5**, 278, 1952)

The effects of X ray upon *Penicillium*, mainly *Penicillium chrysogenum* Q 176 were studied, and the following results were obtained.

The survival curves and the mutation curves of X ray irradiated spores of Q 176 were examined. At the dose of 150,000 roentgen of X ray irradiation only rather ineffective results, i.e. a survival rate of only 10% were obtained.

The expotential curves between the survivors of spores and X ray doses were

approximately straight lines, and this fact was considered to be in good agreement with the Target theory advanced by D. E. LEA.

The types of the mutants which were induced by X ray irradiation could be classified morphologically into several types: i.e., the light type, the sterile type, the albino type, the yeast type, similar to the mutant types in the case of spontaneous variation. And mutation rate could be increased to some extent by irradiation with X ray.

The author could not yet isolate any high penicillin producing strain superior to the parent strain from X ray irradiated spores.

The general effect of X ray irradiation on this mold seemed to be the induction of the various types of mutants which are degenerative and regressive in morphological and penicillin producing properties.

A general review of the recent literature on the effects of X ray upon microbes was given.

51. Microbiological studies of penicillin production. IX. On the pigmentless saltant *P. chrysogenum* Q 176 ARIMA et OGASAWARA. Kei ARIMA and Nagahiro OGASAWARA (Journ. Antibiotics **IV-5**, 281, 1952)

The authors isolated a new mutant strain, in May 1948, which did not produce yellow pigments and yet produce penicillin as well as the parent strain, *P. chrysogenum* Q 176, and named it the Pigmentless Saltant ARIMA et OGASAWARA of *Penicillium chrysogenum* Q 176. In this paper, the morphological characteristics and successful industrial use of this strain in comparison with parent strain were described.

Irradiation condition: This pigmentless saltant was isolated from the spores of *P. chrysogenum* Q 176 suspended in a thin water layer in a Patri dish irradiated at the distance of 50 cm for 5 minutes with ultraviolet ray (100 volt, 1.35 amp., 2537 A occupies 90% of the total radiation, at 1-0.1% survival rate).

Morphological description: Colonies of this strain assume essentially the same appearances as those of the parent strain, except the fact that the reverse and the medium do not turn yellow as the original strain. Colonies upon CZAPEK's solution agar reaches 17 mm to 19 mm diameter after 10-days culture at 24°C, a little restricted velvety textured, showing radial wrinkles, slightly sporting, with outer zone 1-2 mm white, becoming greenish glaucous blue (XLII color table) as conidia develop and mature, exudate colorless, colony reverse dil. baryta yellow (IV color table), substrutum colorless. Conidial structures are irregular as same as the parent strain, conidiophore variable in length from 50 μ to 200 μ, definitely tapered at the apex. Conidia globose to subglobose, smooth, ranging 4.0 μ-3.5 μ, often 6 μ-6.3 μ, pale green in color. Growth rate on CZAPEK agar seems a little slower than the parent strain.

Industrial application: After the pilot plant tests both in tank and surface culture, and the toxicity, pyrogen and the clinical demonstration tests of the penicillin which was the product of the above pilot plant culture, this saltant strain was distributed from the Central Laboratory of Penicillin in Japan, in May 1948, to all the factories in this country, and has been widely recognized of its excellent characteristics in industrial use, and thus contributed to the high qualities and mass production of Penicillin in Japan.

Some industrial characteristics of the strain were as follows:

In tank fermentation the average potencies were 700-800 u/cc (max. 1200 u/cc), using lactose-corn steep medium; and the average 400-500 u/cc (max. 800-1200), using modified STONE and FARRELL's medium broth added with 0.2-0.6% phenylacetic acid, fractionally at proper intervals.

Since this strain did not produce any yellow pigment at all, the purification processes became much simpler, and a white amorphous penicillin with the potency of 1300-1500 u/mg was very easily obtained, and also procaine-penicillin and crystalline penicillin G at the yield of 60-70%, thus remarkably increased the yields of these products as compared with the parent strain.

The ratio of the various types of the penicillin produced by this saltant strain are approximately the same as the parent strain; i.e. penicillin G 50-70%, penicillin K 20-30%, penicillin X 0-3% of the total penicillin.

This strain was ascertained by various tests to be a genetically fixed saltant and to be more stable than the parent strain, which are very convenient characteristics for an industrial strain. The segregation into about ten types of mutants, as shown by the authors in the case of the parent strain, was alos observed in this saltant, but with a much lower mutation rate.

52. Microbiological studies of penicillin production. X. The artificial mutation of penicillin producing molds; Nitrogen-mustard (Methyl-bis-chloroethylamine) induced mutations in *Penicillium*. Kei ARIMA and Shigeo ABE (Journn. Antibiotics **IV-6**, 342, 1952)

By the nitrogen mustard treatment of the spores of *Penicillium chrysogenum* Q 176 for 30 minutes, the survival rate of 1% and the mutation rate of 40% were obtained.

Although, by the nitrogen-mustard treatment, no penicillin producing strain superior to the parent strain could yet be obtained, the rate of the occurrence of pigmentless saltants was remarkably higher than could be expected by X-ray or ultraviolet ray treatments. Other mutant types induced by this reagent were about the same types as in the case of X-ray or ultraviolet ray treatments.

Among the pigmentless saltants obtained, No. 116 strain was studied rather in detail with respect to its morphology, penicillin fermentation on surface and under submerged conditions in pilot plant, toxicity of the preparation, and clinical application. The pigmentless strain No. 116 was found to be almost similar to the pigmentless saltant formerly reported by ARIMA et OGASAWARA.

53. On the Aspergilli of the marron glaces. Hiroshi IIZUKA (Journ. Agr. Chem. Soc. Japan **26**, 68, 1952)

Aspergillus mangini H D is demonstrated as the destructive organisms for the marron glaces. The colonies of this mould upon the CZAPEK's solution agar (3% sucrose) were very restricted, attaining to a diameter of only 3 mm in 12 days at 25°C. For its growth the optimum concentration of sucrose in the media was 60%, and the optimum temperature was 25°C. This mould produced a yellow-green fluorescent substance in the media, which is not founded on ribo-flavin. Crystals of auroglaucin (M.P. 152°) were isolated from the mycelial mat. This mould can not grow in the presence of saturated vapour of alcohol at 20-30°C.

54. On *Aspergillus flavus* LINK as "Koji" mould. Kin-ichiro SAKAGUCHI, Hiroshi

IIZUKA and Jiro OKAMOTO (Journ. Agr. Chem. Soc. Japan **25**, 79, 1951)

According to THOM and RAPER (1945), the species name, *Asp. flavus* may be arbitrarily applied to those members of the *Asp. flavus-oryzae* group whose sterigmata are mostly in two series though single seires are not uncommon in the same head. The authors have found 6 strains of such species out of 49 strains related to the *Asp. flavus-oryzae* series, isolated from spontaneously fermented "Hattchomiso-Koji", or a sort of soy bean Koji for making soy bean paste.

The morphological characteristics of the strains are described. It has been shown that among wild or spontaneously grown Koji-moulds, there may be found *Asp. flavus* LINK, as defined by THOM and RAPER, although such strains have been scarcely recognized by SAKAGUCHI and YAMADA (1944) in about two hundred yellow green Aspergilli which were isolated from "Tane Koji" or cultured starter for Koji making.

55. Studies on the mutation of *Aspergillus Usami* SAKAGUCHI, IIZUKA and YAMAZAKI. Part 1. Ultraviolet ray induced mutation. Hiroshi IIZUKA and Tatsuro YAMAGUCHI (Journ. Agr. Chem. Soc. Japan **26**, 71, 1952)

By the irradiation of ultraviolet ray at 5 cm distance from a mercury lamp (λ=2537 A) for 0.5-3.0 minutes, 81 mutants of *Aspergillus Usammii* SAKAGUCHI, IIZUKA and YAMAZAKI (Records of Researches in the Faculty of Agriculture University of Tokyo **1**, 29, 1952) were obtained. The survival and mutation rate curves are described. These mutants can be classified into 13 types: i.e. the blackish-brown type, the brown type, the tan type, the pigmentless type, the orange mycelium type, the purple drab type, the small heads type, the restricted type, the wet type, the sterile type, the sterile and white mycelium type, the nitrite and nitrate non-assimilative type, and the nitrite non assimilative type.

The colours in conidial heads of these mutants are continuously different; Chaetura Black XV (original strain)→Saccardo's Umber XXIX (strain's No. B-6-604)→Tawny Olive XXIX (strains's No. B-1-207)→Pinkish Buff XXIX or Light Pinkish Cinnamon XXIX (strain's No. B-1-407).

Excepting the conidial colours all of them have the same morphological characters as *Asp. Usamii.*

We also obtained by ultraviolet ray irradiation the mutants of tan type mutant (strain's No. B-1-407). The types of them are as follows: the pigmentless type, the small heads type, the restricted type, the wet type, the sterile type, the sterile and white mycelium type and the nitrite and nitrate non-assimilative type. They all have the same colour in conidial heads as the tan type mutant.

56. Morphological mutation of Koji molds (*Asp. oryzae*) by irradiation of ultraviolet ray. Chiyoko ISHITANI (Journ. Agr. Chem. Soc. Japan **25**, 98, 1951)

The present investigation has been carried out with the object of determining whether or not the S- and F-types obtained by natural variation reverse to the parent (the X-type).

Morphological characteristics of the induced mutants obtained has also been studied.

(1) Ultraviolet rays have been irradiated to the S- and F-types obtained by natural variation of *Asp. oryzae.* aX.

(2) The S- or F-type has been obtained from the parent S-type, and the S-,

F- or X-type from the parent F-type, these mutants have proved to be the same as the natural variants mentioned in (1) above.

(3) The mutants obtained from the S-type are as follows: 1. Normal 2. Restricted 3. Sterile 4. Nitrate non-assimilative 5. "Nitratophobe" 6. Heavy 7. Olive 8. Brown 9. Albino 10. Floccose 11. Yeast and 12. Maroon-exudate.

The mutants obtained from the F-type are as follows: 1. Normal 2. Restricted 3. Sterile 4. Nitrate non-assimilative 5. "Nitratophobe" 6. Normal (S) 7. Restricted (S) 8. Brown 9. Yellow and 10. X.

Of the above-mentioned mutants those which are not described by IGUCHI are Yeast and Maroon exudate.

A new kind of mutant that does not grow even on such media as Koji-agar and malt-extract-agar has also been found.

(4) The conidia of the S- and F-type which are natural variants are of comparatively uniform size. As to the induced mutants, the conidia of the mutants from the S-type, except for "Nitratophobe", Brown and Floccose, are comparatively similar in size to those of the parent.

The conidia of the mutants from the F-type are generally rich in variety of sizes.

(5) The shape and size of each organ which are used as the standards for the classification of *Asp. oryzae* strains have been found to be remarkably changed by ultraviolet ray irradiation.

57. Studies on the streptomycin-producing streptomyces. 1. Isolation of strain, identification of antibiotics substances, and morphological observation. Noboru KATSUYA, Heiichi SAKAI, Eitaro KOMATSU and Osamu MAKABE (Journ. Antibiotics **6**, 425, 1951)

The authors have isolated four streptomycin-producing strains (No. 105, 110, 262, 601) from soil samples collected from all over Japan. The antibiotic substances of these strains have been identified as streptomycin by biological and chemical method.

The strain No. 601 produces the highest streptomycin potency and the WAKSMAN's glucose bouillon is the most suitable medium for streptomycin production. But this medium is not necessarily suitable for other strains.

The morphological characters of these four strains were compared with those of other streptomycin-producing strains described before. All of these four strains are considered to belong to *S. griseus* described by WAKSMAN, but No. 262 and No. 601 show peculiar character on pigment production in synthetic media.

58. Studies on the heat resistance of bacterial spores. Part I. On the method of determining the heat resistance, and the effects of several factors. Kin-ichiro SAKAGUCHI and Mikio AMAHA (Journ. Agr. Chem. Soc. Japan **25**, 104, 1951)

The method we used to determine the heat resistance of aerobic bacteria is a modification of the method of O. B. WILLIAMS (1929). The spores were harvested from nutrient agar slant, suspended in sterile neutral phosphate buffer, and filtered through a sterile filter paper to remove clumps of spores. The spore suspension was counted by means of haemacytometer and diluted so as to contain a definite number of spores. Then the suspension was pipetted into small glass tubes and heated in a boiling water bath.

The "basic heat resistance" of spores of the aerobes (i.e. the survival time at 100 C. with a spore concentration of 50 millions per ml.) were as follows:

Bac. subtilis............10 minutes, *Bac. mesentericus*............10 minutes,
Bac. megatherium... 8 ,, , *Bac. mycoides*..................10 ,, ,
Bac. natto...............16 ,, .

The unfiltered spore suspensions containing clumps of spores have shown higher heat resistance than the filtered suspensions. But in the former case the "skips" occurred and it was impossible to obtain definite results.

The effects of several factors on the heat resistance of spores of Bac. subtilis were investigated.

59. Studies on the heat resistance of bacterial spores. Part 2: Relationships between spore concentration and survival time. Mikio AMAHA and Kin-ichiro SAKAGUCHI (Journ. Agr. Chem. Soc. Japan **25**, 140, 1951)

The authors have investigated the relationships between the spore concentrations and the survival times at 100 C and 95 C in neutral phosphate buffer solution, using *Bacillus natto* and *Bacillus megatherium* as test organisms.

The relationships between the logarithms of spore concentrations and the logarithms of the survival times were found to be linear as expressed in the following formula:

$$\log_{10} N = a + b \cdot \log_{10} t$$

where N is the spore number per ml., t the survival time in minutes, and a and b constants specific to the strain, temperature, and the nature of suspending medium. When the spores were suspended and heated in nutrient broth of pH 6.9, the relationships also followed the above formula.

It has been shown clearly that the main cause of the increases of the survival time with the spore concentration can not be attributed to the selectivity of the more resistant individuals, as hitherto supposed. Some other fundamental causes of physico-chemical nature must be at work in the above relation.

60. Studies on the acid fermentation of *Rhizopus* species. Part 7. On the submerged fermentation under aeration. Kin'ichiro SAKAGUCHI, Chōseki FURUSAKA and Hajime TAKAHASHI (Journ. Agr. Chem. Soc. of Japan **25**, 150-152, 1951)

The purpose of the present study is to confirm the result of SAKAGUCHI, and ASAI and HONGO (1943), who found that in the submerged state, *Rhizopus* species belonging to the lactic acid former produce large amount of fumaric acid along with lactic acid.

A laboratory scale fermenter was constructed by the authors, and the submerged fermentation of the *Rhizpus* species was carried out. The results of the experiments were as follows:

1. *Rh.* G. 36, the lactic acid former produced a large amount of lactic acid under strong aeration and agitation, and a noticeable production of fumaric acid (0.65 to 3.22% of the glucose consumed) along with lactic acid (43.13 to 57.61% of the glucose consumed) was also confirmed.

2. In the mixed culture of *Rh.* G. 36 and *Rh.* G. 34, the fumaric acid former, a larger amount of fumaric acid compared with that of lactic acid could be obtained.

61. Studies on the acid fermentation of *Rhizopus* species. Part 8. On the

anaerobic fermentation. Kin'ichiro SAKAGUCHI, Hajime TAKAHA:HI and Jun'ichiro KATAOKA (Journ. Agr. Chem. Soc. of Japan **25**, 180-185 1951)

Concerning the anaerobic fermentation of *Rhizopus* species SAKAGUCHI, ASAI and HONGO (1948) found that the acids production always decreased under an anaerobic condition. But recently (1941-1949) FOSTER et al. reported the formation of a remarkable amount of fumaric acid from glucose under a strictly anaerobic condition, with the fixation of carbon dioxide involved.

So the anerobic fermentation of some sixty strains of *Rhizopus* were carried out, and the following results were obtained:

1. Through the investigation of the anaerobic fermentation by more than sixty strains of *Rhizopus*, it has been found that the anaerobicity always decreases the glucose consumption as well as the acid production, and that the acids produced are chiefly lactic acid and none or traces of fumaric acid are found.

2. From the above results and the carbon valance theory, we consider that in the case of the sixty strains tested, fumaric acid was produced from glucose exclusively by way of the THUNBERG-WIELAND's scheme and not through the WOOD-WERKMAN's. The strain which was used by J. W. FOSTER et al. and which produced fumaric acid anaerobically involving the fixation of carbon dioxide, may therefore be of an extraordinary nature.

3. The aerobic lactic acid fermentation of *Rhizopus* is hindered by the addition of 2,6-dichlorophenolindophenol, while fumaric acid production is quite unaffected. Since dyestuff causes the depression of fermentation and the acceleration of respiration, it is quite obvious that fumaric acid is an oxidative product, while lactic acid is not.

62. Studies on the respiratory activity of *Rhizopus*. On the oxidation of various substrates and on autorespiration. Hajime TAKAHASHI (Journ. Ferment. Ass. **9**, 14-21, 1951)

1. The oxidation of various organic acids and peptone by the living pellicle of *Rh.* G. 34, the fumaric acid former, was examined. Among the various substrates tested, only glucose, peptone and acetate were oxidized rapidly.

2. Acetate was oxidized almost completely (R.Q.=0.96-0.98), and a remarkable induction period (20-30 min.) of the oxidation was always observed. Inhibition experiments were carried out and it was found out that arsenite, cyanide, sodium fluoride, monofluoroacetate and 2,4-dinitrophenol inhibit the oxidation greatly.

From the above facts, the author concludes that the mechanism of acetate oxidation by *Rh.* G. 34 may involve the citric acid cycle along with C_4-dicarboxylic acid cycle.

3. Dried cell preparation of *Rh.* G. 34 was found to contain succinic oxidizing enzyme which is inhibited by malonate. Since the livng pellicle does not oxidize succinate at a detectable rate, the permeability might be limiting the oxidation of organic acids such as succinic, fumaric, malic and citric acids.

4. The spores of *Rh.* G. 34 were found to oxidize glucose and peptone. From three hours after the addition of substrates germination was observed only when peptone was added as substrate.

5. Autorespiration of *Rh.* G. 34 was studied extensively, and it is suggested that there exist at least two oxidative reactions. One is inhibited by sodium fluoride,

and the other is not. The R.Q. of the former reaction is 0.6-0.8, and that of the latter is about 1. The latter reaction seems to be the main reaction in the autorespiration of the pellicle of *Rhizopus*.

The substrate of the latter reaction was extracted from the pellicle and partially purified. The substance exhibited the strong reaction of pentose (Bial reaction). Besides, the crude fraction of ribonucleic acid obtained from the fungus pellicle by the method of EULER et al. (1948), was oxidized by the cell rapidly.

From the above facts, the author concludes that the substrate of autorespiration may be very closely related to ribonucleic acid. But during the oxidation of the ribonucleic acid fraction by the fungus, no consumption of pentose was recognized.

63. Studies on the natural variation of Koji-molds (*Asp. oryzae* and *Asp. sojae*). Part 1. On the relation between morphological characteristics of various strains and the occurrence of variation, and the morphology of the variants obtained and its related strains. Kin'ichiro SAKAGUCHI and Chiyoko ISHITANI (Journ. Agr. Chem. Soc. Japan **26**, 18, 1952)

(1) Natural variation in monospore lines of Koji-molds (*Asp. oryzae*, *Asp. sojae* and its related strains) isolated from the commercial Koji materials or soils and from the stock cultures of the authors' laboratory has been observed.

(2) There seem to be two groups of strains in about 100 strains of Koji molds investigated, one group consisting of inconstant strains which are very liable to produce natural variants and the other consisting of the strains which remain constant through many generations.

(3) The inconstant strains exhibit conidia bearing partly floccose colonies (X-type). They generally form large conidia. (*Asp. oyzae* var. *magnasporus* and some members belonging to *Asp. oryzae* s. str. which produce large conidia occasionally). The colonies of the constant strains show abundant conidium formation and smooth surface (S type or sporogenous type). Sizes of the conidia are mostly small (*Asp. oryzae* var. *microsporus*) or medium (*Asp. oryzae* s. str.).

(4) The variations are more frequent among the so called "Wild strains" isolated from soils or Koji factories than among the strains from stock cultures, or "culture strains".

(5) The colony types of the variants on CZAPEK agar are as follows: S (sporogenous, whole surface covered with conidia), F (floccose), FR (F-restricted), FN (floccose but very faint growth upon CZAPEK agar, or nitrate less assimilative strains), N (no growth on CZAPEK agar, or nitrate non-assimilative), LS (semi lethal, or growth being stopped directly after germination), L (lethal, or no growth on any media).

(6) Pedigree cultures of 8 inconstant strains have been carried out, but no definite segregation ratios of each variant type has been recognized through the successive generations.

(7) Strains belonging to each variant type have ordinarily become constant or fixed after 5 or 6 generations of pedigree cultures which were carried out at the intervals of 10-14 days, with 80-100 colonies by monospore culture taken at each generation. From old cultures of some fixed strains which have been kept for about 5 months at room temperature, remarkable segregations have again been recognized.

(8) The LS or L type strains were commonly obtainable from the strains of the F-type.

64. On the vitamin B_{12} production by fermentation. 1. The microbiological assay of B_{12} by *Lactobacillus*. Heiichi SAKAI and Toshinao TSUNODA (Journ. Antibiotic **6**, 352, 1951)

The microbiological assay for vitamin B_{12} using *L. lactis* DORNER has been developed.

A quantitative analysis of vitamin B_{12} (L. L. D. Factor) contained in antibiotic broths and several other natural substances has been carried out. (Table 1) *Streptomyces* group has distinctly higher B_{12} potency than other bacteria and fungi.

The vitamin B_{12} production of streptomycin-producing *S. griseus* was observed during streptomycin fermentation.

Table I.

	Vit. B_{12} (L.L.D. Factor)
Streptomycin broth	20 mg/cc
Penicillin broth	1.2
Yeast extract	1
Bouillon	3
Liver bouillon	75
Milk	2.5
Koji water (Bé 10°)	1.8

65. Studies on the mesophilic cellulose-decomposing bacteria. Part 4 (1). On the characters of cellulolytic Pseudomonads as the oxidative bacteria. Toshinobu ASAI and Kiyomoto UEDA (Journ. Agr. Chem. Soc. Japan **25**, 303, 1952)

Some of the cellulolytic Pseudomonads which we have isolated possess the character of the oxidative bacteria.

These bacteria produce 2-ketogluconic acid from gluconic acid, but no acid from glucose.

This character is very different from that ordinary oxidative Pseudomonads which produce gluconic acid or 2-ketogluconic acid from glucose.

Thus in the production of 2-ketogluconic acid it is advisable to add peptone to the culture media and prior to inoculation to transfer them on bouillon agar from the starch agar stock culture.

Part 5 (1). Taxonomical study on genus *Sporocytophaga* Kiyomoto UEDA, Shichiro ISHIKAWA, Turu ITAMI and Toshinobu ASAI (Ibid. **25**, 543, 1952)

To enrich the various cellulolytic bacteria, 68 kinds of soil, from Hokkaido and the east of the mainland of Japan, were inoculated in filterpaper medium under various conditions. *Sporocytophaga* was the most dominant cellulolytic bacteria in the forest soils. 13 strains of *Sporocytophaga* were isolated and studied taxonomically, and 4 new different strains were found out from these bacteria. Based on these 4 species, we propose that the key to the species of genus *Sporocytophaga* in BERGEY'S Mannual (6th ed.) must be subdivided as follows.

The type species is *Sporocytophaga myxococcoides* KRZEMIENIEWSKA and STANIER.

I. Microcyst spherical
  A. Does not utilize starch
    a. Growth feebly or not at all on bouillon agar
      i. *Sporocytophaga myxococcoides*

α. Produces nitrite from nitrate but produces no ammonia from peptone.
Sp. myxococcoides α *

β. Produces ammonia from peptone but produces no nitrite from nitrate.
Sp. myxococcoides β *

γ. Produces neither nitrite nor ammonia. *Sp. myxococcoides* γ *

aa. Growth abundantly on bouillon agar

ii. *Sporocytophaga ochracea* *

B. Utilizes starch

iii. *Sporocytophaga congregata*

II. Microcyst ellipsoidal

iv. *Sporocytophaga ellipsospra*

Several interesting photographs of Sporocytophaga were obtained through electron-microscopic studies.

Part 5 (2). Taxonomical study on genus *Pseudomonas*. (Ibid. **26**, 35, 1952)

4 new species of aerobic mesophilic cellulose-decomposing bacteria were isolated, which should be placed in genus *Pseudomonas*.

Based on these 4 species, we propose that the key to the species of genus *Pseudomonas* in BERGEY's Manual (6th ed.) must be subdivided.

As an addition to BERGEY's Manual:

Genus *Pseudomonas*

I. Soil and flesh water forms

1. Green fluorescent pigment produced

a. Gelatin liquefied

b. Polar flagellate

c. Grows readily at 30°. Usually bluish-green. Not known to digest cellulose.

Pseudomonas fluorescens

cc. Digests cellulose

Pseudomonas fluorescens var. *cellulosa* *

2. Green fluorescent pigment not produced.

a. Gelatin liquefied

b. Polar flagellate

c. Grows poorly or not at all at 37°

dd. Slow reduction of litmus and becomes alkaline

e. Not known to digest cellulose

Pseudomonas mephitica, *Pseudomonas gemiculata*

ee. Digests cellulose

Pseudomonas alboflava *

....

Pseudomonas viscosissima *

Pseudomonas rubeorifaciens *

....

66. Microbial degumming of fibers. Part 8. The action of degumming enzyme of *Aspergillus niger*. Toshinobu ASAI and Hiûga SAITO (Journ. Agr. Chem. Soc. Japan **25**, 307-310, 1952)

In using the crude enzyme preparation of *Aspergillus niger* sp., conditions of

degumming action on ramie fiber, which has been considered mainly through the microbial protopectinase, are studied. The mold is incubated for 4 days at 30°C on wheat bran added with alkali-scouring-waste-liquor of ramie as pectic source and the water-extract of the thus obtained mold-bran is condensed in vacuo, dialyzed and precipitated with ethanol (80% vol.). After washing with ethanol and drying in vacuo, this preparation shows such an activity that in several hours it depectinizes about 80% of the native pectin in ramie fiber retted in a low 0.05% solution of it, and can be stored without any loss of the activity for more than a year. The depectinizing reaction is likely of the first order until dissolution of the pectin goes to the extent of 80%, and hardly proceeds anymore, though in higher concentration of the enzyme or elongated period of the action, which is probably due to the structural resistance of the pectic substance for further enzymatic degradation. Addition of oxalate accelerates the action to complete the degumming, while Ca^{++} ion prevents it markedly. These phenomena suggests that the pectic substance in parenchyma of ramie has a close relation to Ca^{++} ion probably in forming Ca-pectinate or Ca-bridged protopectin as pictured by HENGLEIN in 1943. The optimal conditions for the depectinizing action are found to be pH 3-4 and 40°C. The enzyme is stable in considerably acidic solution and inactivated by treatment at 60°C for 2 hours.

67. Konjac-desizing by bacterial mannanase. Toshinobu ASAI and Hiûga SAITO (Journ. Agr. Chem. Soc. Japan **25**, 431-436, 1952)

An useful bacterium for the desizing of ramie cloth sized with konjac (*Amorphophallus konjac*), which seems to belong to the *Bacillus subtilis* species, is isolated. This bacterium excretes powerful mannanase which degrades konjac gluco-mannan probably not into monosaccharides but into lower polymers, (i.e. from konjac mannin to laevidulinose), which have low viscosity and lose coagulability with alkali whereas native gluco-mannan has high viscosity and coagulability. Thus effective desizing is achieved by such a reaction that can be traced by measuring the viscosity decrease. For the practical preparation of the desizing agent, the solid culture method is economical. According to the studies of cultural conditions the following method is suitable for the enzyme production; i.e. rice bran neutralized with caustic soda to pH 6 or higher with the same volume of water are cooked and inoculated. The optimal cultural pH values differ from 6 to 8 according to the substrate materials used.

Within 2 or 3 days of incubation at 30-37°C, the enzyme activity rises to its maximum. The lower the incubation temperature is, the longer the period required becomes, but the loss of the enzyme activity diminishes owing probably to the prolonged autolysis. This crop may be dried in the open air and stored in a dry state without loss of the activity for more than several months. Enough mannanase is produced even in the absence of the appropriate substrate, konjac mannan, so as not to become adaptive enzyme.

Optimal conditions for the enzyme action are at pH 6 and 50-60°C; below pH 5 and over 70°C the mannanase is made considerably inactive, but its high activity in a relatively wide range of pH 6-8 and in higher temperatures makes it utilizable for industrial purposes (inactivation is not complete even after boiling nearly an hour). It is desirable to carry out the desizing at a relatively low temperature and with a

high degree of concentration of the agent. The residual liquor may be used repeatedly.

68. Studies on the utilization of the WALDHOF Fermentor. Part I. Production of fodder yeast from sulphite waste liquor. Kôichi YAMADA, Takashi ITO, Akira KOYAMA and Yukihiko HANDA (Journ. Agr. Chem. Soc. Japan **25**, 173, 1951)

The continuous fodder yeast production from sulphite waste liquor by using modified WALDHOF Fermentor was investigated at the Inuyama Pulp Mill of Toyo Spinning Company. When sulphite liquor containing 4.5% sugar was fed at the rate of 3.5 l. per hour for the total liquid volume of 18 l., the yield of dry yeast (*Mycotorula japonica* SAKAGUCHI et YAMAGUCHI) was 39% and 61%, respectively for the total and consumed sugar. Air was conducted at the rate of 1 or 1/2 volume for the fermented liquor without showing any difference in the results. Recently, a 5 ton WALDHOF Fermentor has been under operation with favourable results in the Inuyama Pulp Mill.

69. Studies on the thermophilic cellulose decomposing bacteria. Part 1. Some information about cultural environments and isolation techniques. Kôichi YAMADA, Yoshinori FUJIMOTO and Yuzuru FUNADA (Journ. Agr. Chem. Soc. Japan **25**, 200-205, 1951)

Cultural environments for the thermophilic cellulose fermentation were examined as a preliminary experiment for the isolation of the cellulose decomposer. Various techniques, for example, the enrichment method, the dilution or heating method and the application of bacteriostatic agents, and the like, were used in order to obtain a pure culture, but some contaminants were always found. Generally, the reproduction time of thermophile was so rapid that it was practically impossible to obtain a homogeneous culture for the purpose of the filteration method and the SNIESZKO's method.

Cellulose fermentation proceeded under a reduced condition and Eh measured at active culture was $-20 \sim -50$ mv. Moreover the cellulose decomposer was an obligate anaerobe in contrast to the facultative aerobic contaminants, so that the agar plating method was examined with Na-carboxyl methyl cellulose, cellodextrin and cellobiose as carbon source under a suitable rH and an aerobical condition with carbon dioxide or nitrogen gas. By this method the culture of cellulose thermophiles were gained almost purely, but these failed to digest cellulose and to recover their activity.

The vegetative cells were thin rods, straight or slightly curved, the majority of them being 0.2 to 0.6 μ by 2 to 6 μ. The spore were terminal and measured 0.6 μ by 0.7 to 0.8 μ. A contaminant was found to be very similar to *Bac. thermofibrincolus* which was reported though not confirmed to be a cellulose fermenter, so it is doubtful whether *Bac. thirmofibrincolus* is a cellulose decomposing bacterium.

III. Agricultural Economics

Abstracts No. 70

70. Jottings on social character of rice diet. Seiichi TOBATA (Nōgyō Sogo Kenkyū—Quarterly Journal of Agricultural Economy 4, 1950)

Introduction. A few decades ago one foreigner declared at an international conference that if the living standard in Japan became higher, the Japanese would be eating more wheat instead of rice. The implication was that the rice-eating Asiatic nations were inferior to those European nations where wheat is the staple food. The Japanese attending the conference vigorously protested that in their own country those on the lower economic strata lived on wheat and barley while the better-to-do subsisted on rice.

Generally speaking, in prewar Japan only the very poor farmers ate wheat and barley while they sold the rice they produced for cash income. If, however, Japanese started to eat bread, which is made from wheat, instead of rice, would it mean that their standard of living has gone down?

When Dr. Henry C. TAYLOR, the authority in agricultural economy, came to Japan in 1932, he pointed out to me that the money each Japanese household spent for buying rice is tremendous in comparison with expenses for other food items and that here was something we should ponder about. Indeed, compared with bread, the "staple food" in the western world, rice comprises a tremendous proportion in the Japanese diet. But we must not overlook the fact that the rice in the Japanese diet is not analogous to bread in the Occidental diet. In many instances rice in Japan is not only "staple food" but also counterparts of meat, vegetables and other miscellaneous food items. This view which I entertained 18 years ago I have not revised.

Typical Lunch. A typical Japanese lunch for the lower class people is rice balls with one or more "umeboshi" or salted plums. In this instance, "umeboshi" is merely an appetizer and does not count as nourishment. During and after the war for a few years, I saw many decently-dressed men on public conveyances gobbling rice balls. If Dr. TAYLOR had seen such a scene, he would have agreed with me that Japanese ate both "staple" and supplementary foods in one item—rice.

Rice is an extremely convenient food. It contains all varieties of nourishment though in small quantities necessary for the human body. The only other food which is nutritiously adequate by itself is mother's breast milk. If, for instance, one ate nothing but bread or fish day after day, he would be undernourished within a week. It is perhaps because of the omnipotence of rice that one never tires of it.

Although my own stomach infinitely covets rice, my brains do not necessarily commend my eating habit. Rice is a handy food in that it contains nourishments found in other food items, but it also has disadvantages. Because our health is maintained as long as we can eat rice, we have become mentally idle as far as our dietary contemplations are concerned. Living on a rice diet, one becomes mentally lethargic because he does not have to use his brains at all. If, on the other hand,

our nation had lived on wheat for the last centuries, we would be quite different from what we are today. Living on wheat, on the other hand, one has to use one's brains constantly to find a suitable supplementary idet to maintain a balanced nourishment. In other words, rice is an "isolationist," whereas wheat may be called a "coalitionist."

Faces Mental Drill. Furthermore, in preparing a meal including wheat and its derivative; there are infinite possibilities of combining staple and supplementary foods. For each meal, we must select one of the many such combinations, which means that a wheat-eater faces that mental drill at least three times a day. The mental training a wheat diet offers us daily is, therefore, indeed tremendous.

According to a survey, an adult Japanese farmer eats more than 6 go-s of rice a day, and even a child consumes at least 4 go-s of it. Assuming that the average farming family consists of four members, it would require nearly 9 kokus of rice every year for subsistence, which means that the family needs at least one acre of rice paddy in order to be self-sufficient. Since the average acreage of arable land owned by farming households in Japan before the war, when the number of small-size farmers was not quite as large as today, was 1.47 acres, the self-sufficiency of the Japanese farmer must be said to stand on a very slim basis.

If a farmer owns a piece of rice paddy, he would have to be producing nothing but rice year in and year out in order to live. But if the land was not fit for rice culture, the farmer would have to use his brains about what to raise on his farm so that he could gain some cash income to supplement his food values. In Japan only rice-producing farmers are entitled to the privilege of self-sufficiency.

In South Korea and in northeastern Japan, farmers literally eat almost nothing but rice. This might appear to be an enviable privilege to the rice-hungry urban population, whose rice ration for the last year was only 58 per cent of all the government-distributed foods. These farmers, however, cannot eat anything else but rice because they have no land on which to raise other food items. Life on nothing but rice is monotonous, tasteless and colorless. I have personally observed these farmers eat their victuals joylessly and silently, almost like animals.

Follow Habit. On the other hand, the farmer who cultivates dry land must, no matter how small the lot, eat more than one food item. They have to eat even fish together with sweet potatoes in order to secure sufficient nourishment.

Non-rice agriculture makes the farmers economically more active because he has to exchange his produce with others on the market. Rice culture, therefore, minimizes for the farmer the possibility of selection of ways of land utilization as well as of rational thinking. Today most Japanese farmers till land to raise rice because that is what their forebears have done for generations past. They blindly follow their ancestors' ways without independent and creative thinking.

Wheat culture, however, offers the farmer opportunities for economic training because it demands constant use of his brains. In this sense rice culture signifies mental poverty, whereas wheat culture is an expressionf of freedom or of possibility of choice.

If the standard of living in Japan were raised, people might eat wheat in preference to rice. If the farmers' intelligence advances, they might switch from rice culture to other production. I hope that Japanese agriculture will pay more respect to brains than to the stomach.

IV. Agricultural Engineering

Abstracts Nos. 71—82

71. Report of survey concerning land subsidence at Watanabe-mura, Iwaki-gun, Fukusima Prefecture. Masuji AKIBA (Rept. Tohoku Branch Agr. Eng. Soc. I, 1951)

The district surveyed is located 12 Km south of Taira-city and about 4 Km from Yumoto.

Some change has begun to appear in the water level of wells since 1939, and subsidence of cultivated land occurred since about 1940, the damaged area reaching about 16.9 ha and houses, electric poles, reservoirs, canals, etc. also being damaged.

The causes of and measures to be taken against the subsidence in the locality are summarized as follows:

(1) Causes of sinking and subsidence.

The soil of paddy areas, especially such soft muddy soil as in this locality, has generally a small bearing power, and the subsidence may be considered to have been brought about by the embankment of the old Same river, but that was never the case, and being muddy clay with moisture, may any change of volume of soil take place due to removal of the water content? In this case the pressure equals to the weight of soil more than 10 m, and the question is how has removal of the water content taken place? Being paddy fields, when moisture would have constantly been supplied, complete removal was impossible.

In short the above two items must be investigated. Let us consider if the subsidence occurred only in the paddy fields due to dehydration of the muddy soil. As the subsided places were in the state of paddy fields or ponds, and water had been constantly supplemental, a perfect dehydration due to consolidation was not possible; and if we assume that consolidation dehydration takes place only by the removal of ground water, the subsidence of cultivated land will progress very slowly, and the land slide in the neighborhood of hilly areas may occur on account the secondary land slide at the unstable places due to the subsidence of paddy areas.

However, judging from the slanted electric poles and cottages on a considerably high hill and cracks of a wide range on the hilly and upland areas, it is supposed that the land movement of the hilly areas themselves has taken place, but it can be not considered the particular activity in regard to the land movement has begun, judging from the state of faults.

Thus we can attribute the above mentioned accidents to the change of the underground structure due to the ground water disturbance, which was caused by the falling ground and drainage of the coal mine. The falling ground in the coal mine caused frequently coal mine earthquakes in this locality.

(2) Measures.

It would be very difficult to obtain a desired result unless the progress of subsidence is considered from the standpoint of land use and suitable measures are put into practice. In the first place levelling of the area in question must be practised

to measure the velocity of the progress, and after the ground has been settled, the measures must be carried out. Such works as soil dressing, pumping facilities, tightening of farm bed, cutting-down of canal bottom, utilization of water surface, etc. are quite suitable measures to be executed in such case.

In case where a wide area was not destroyed by subsidence, you can rehabilitate the damaged land by soil dressing, so that irrigation may smoothly be practised in paddy fields, mountain soil in the neighborhood be used for soil dressing, but if the embankment of the old Same river is utilized for this purpose, the reclaimed land created at the embankment site will do a better service for food production. In this case a careful attension must be paid toward the method: it is safe to get away topsoil of the paddy at first and then bring back the soil after the operation of soil dressing is finished. However, as this method is quite expensive, we must at first confirm whether cutting down of the canal bottom is possible or not, and if possible, practise drainage by the enlarged canal, reduce pond area and try to build terraced paddies without creating large flat fields as much as possible.

72. Interception of rainfall by vegetable canopy. I. Masuji AKIBA and Yasuo GOTO (Journ. Agr. Eng. Soc. Japan **19** (4) 284-294, 1952)

Interception of rainfall is considered to have a close connection with soil conservation and flood control as follows:

(1) Part of intercepted rainfall evaporates directly without reaching the ground, or reaches it after retardation of time even if it does so, being checked by leaves and stalks; (2) leaves and stalks can effectively prevent the impact raindrops, and minimize damage upon the soil structure due to the impact of rainfall; (3) they help part of intercepted rainfall dropping from leaves and stalks infiltrate into the soil.

In order to investigate the above phemonena, comparative research on the varying rates of interception and infiltration of rainfall caused by different kinds of crops, different cultures, crops growing seasons, intensity of rainfall, etc., was put into practice.

Several sets of small rain gauges of 35.7 mm and 50.4 mm in diam. which were manufactured for the trial, were set up in furrows for such small crops as upland rice, wheat and corn. Raingauges set up at 3 points A, B and C in a row spacing composed a set of raingauges. (A at a stock of crop, C at an intermediate point between two stocks and B between A and C). A regular raingauge of 20 cm in diam. was established in the open field to observe precipitation. If the percentages in the data of the rainfall by each small raingauges and the regular raingauge are observed, and those at three points are expressed by a, b, c, the mean value $\frac{a+b+c}{3}$ will be the average rainfall rate when a rainfall reached the ground. The distribution of rainfall can be known by taking the mean value of several sets of a, b, c. In case of mulberry, 20 cm raingauges were adopted, but the other raingauges were used for upland rice.

As for upland rice, when the grounded reaching ratio (100—ground reaching ratio = interception ratio) was taken on ordinate and the period on abscissa, the following Fig. 1 was obtained. At the end of September, the ripening stage, the maximum interception ratio (about 40%) was reached, and before the period the ratio was increasing with the growth of rice plant.

As for mulberry the change of the ground reaching ratio is shown by Fig. 2, which does not show any remarkable difference due to the intensity of rainfall.

Though the checking capacities against rainfall of leaves and stalks of upland rice had been supposed to be 0.63 mm~0.76 mm, and 1.4 mm in mulberry during the maximum period.

The values obtained by the above experiment, however, showed that the rain-water which reached the raingauges in row spacing after being intercepted remarkably decreased. Even if evaporation had occurred directly from leaves and stalks during rainfalls beside the check of the latter, the greater part of the water amount beside the above is considered to have reached the ground directly by the help of the leaves and stalks in the course of rainfall.

In case where the average of larger rainfalls then 5 mm was taken, the corn showed an interception of 20% at the beginning of June (plant height 30 cm), 50% at the end of June (plant height 50 cm~80 cm) 65% in July (plant height 100 cm~120 cm) and 60~50% in August, by which an interception more than 50% in the course of about 2/3 of the growing season from the end of May to the early part of September was shown. Wheat showed an interception of about 15% in May, its maturing stage.

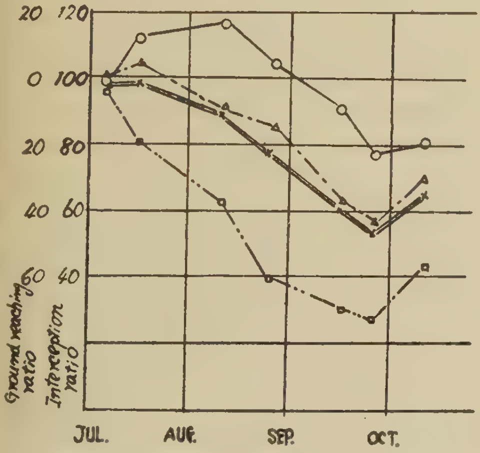


Fig. 1. Relation between period and ground reaching ratio.

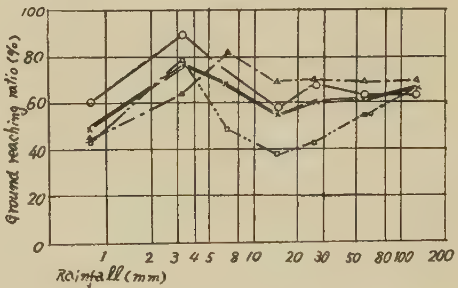


Fig. 2. Relation between precipitation and ground reaching ratio at mulberry farm.

73. On the durability of materials of underdrainage works. Masuji AKIBA and Yoshiharu IWASAKI (Rept. Tohoku Branch Agr. Eng. Soc. II, 1952)

In order to investigate the durability of materials of underdrainage works, it was necessary to select representative localities and practise material test all over the country. The authors first picked out Hirono-mura, Yamagata Pref. and started a survey concerning the above in April 1951.

In this village underdrainage work had been practical about 12 years and the materials used in the practice were brushwood, miscanthus, straw and concrete pipes (Hume pipes).

The result obtained by the test was as follows:

(1) Verticel compressive test of brushwood and miscanthus.

The strength of miscanthus was reduced to 1/2∼1/3 of the original after 12 years, and that of miscanthus to 1/2.3.

(2) Bending test of brushwood and miscanthus.

The bending strength of brushwood was reduced to 1/1.7 of the original material after 12 years and that of miscanthus to 1/2.3.

Thus brushwood is better than miscanthus from the standpoint of durability. By the comparison of both materials the following result was obtained:

Brushwood had a strength 3 times as much as miscanthus for new materials, and moreover, the former was 3.5 times stronger than the latter for old materials, and this fact told the authors that brushwood is by far the stronger of the two materials.

(3) Concrete pipe.

Corrosive tendency was seen near the joints of outside forms, the places of which had only 1/2 strength when compared with other places in case of old pipes; but such phenomenon wasn't seen on new pipes.

(4) Result of straw test.

The strength of material was more weakened in case where shearing strength was implicated on tensible strength than the material was under tensible strength only. Shearing and tensile strengths of the material both diminished to 1/11 of the original strength.

(5) Comparative test of ashes of burned materials.

Comparison was taken of the amounts of ashes of new and old materials,—straw, miscanthus and brushwood, the result of which was as follows:

The old brushwood diminished to 1/3.5 of the new, the old straw to about 1/2 of the new and the old miscanthus to about 6/100 of the new.

(6) The pores among pebbles of underdrainage works were choked up by a considerable amount of sand, and the sectional area was reduced very much. It was concluded from the above test that the life during which the drainage function will fully be accomplished was different according to the materials used; the survey results were as follows: Straw had a life of 6∼7 years, miscanthus 13∼14 years, and brushwood enjoyed a little longer life than miscanthus.

Appreciable inflow of sand was not perceived in case of a concrete pipe, but at such peat soil as the surveyed area the pipe would gradually be weakened by corrosion. If it were destroyed, the whole drainage function would be stopped; this is a different point from other materials. Such being the case, it is quite a noteworthy fact that a concrete pipe enjoys sometimes a shorter life than a straw, miscanthus or brushwood works. In such a case earthen pipes are rather recommendable for this purpose.

74. An example of water warming effect of reservoirs. Masuji AKIBA, Shozo NOGUCHI and Yasuo GOTO (Journ. Agri. Eng. Soc. Japan **20** (1), 45-47, 1952)

A survey was practised for three reservoirs in Shiojiri-machi, Nagano Prefecture—Mukosaka, Tagawaura and Mitake which are 720∼820 m in height—in order to establish a standard of a water warming reservoir.

Mukosaka-ike and the two other reservoirs had the following capacities at the time of survey.

Mukosaka-ike;	
Maximan water depth	12 m
Water area	3.5 ha
Tagawaura which is adjecent to Mukosaka-ike	
Max. water depth	5 m
Water area	about 0.7 ha
Mitake-ike	
Max. water depth	only 1.8 m
Water area	0.15 ha

Comparison of the water warming capacities was made according to the water-depths and areas of these reservoirs.

Observation was made ranging 5 days, 24th to 28th July, 1951, the result of which are summarized as follows:

(1) As for water warming capacity, Mitake-ike which is the shallowest and smallest in depth and area, and moreover, has the least inflow is better than Mukosaka-ike. The temperature difference of water flowing in and out of the reservoirs reached 10.5°~13.0°C.

(2) In Mukosaka-ike the temperature difference of the water surface was 4.9°C, while that of the atmosphere showed 10.9°C, and in Mitake-ike the former was 6.0°~7.0°C while the latter reached 15.5°C. In a small reservoir a tendency is seen as the water is easily warmed in the daytime, but easily cooled down at night.

(3) Judging from the observations practised concerning reservoirs in various prefectures up to now and from the present survey, the recommendable water depth for water warming reservoirs is 2.0 m~4.0 m, and for those deeper than 5 m, the water warming effect can not be expected.

(4) In case of smaller reservoirs there are such examples in which equipments to disperse water near the intakes were provided and better results for water warming obtained; though, while water is warmed by day, water temperature will be lowered at night by such provisions. In case of Mitake-ike the water amount drawn in is little compared with its capacity and such an equipment is not recommendable.

(5) The intake shall be located at such a place as the surface water can be drawn, and at the same time shape and covers along the shore of a reservoir, sunshine, wind direction, etc. shall also be taken into consideration.

(6) Mukosaka-ike has an inclined outlet pipe upon the upstream slope of the dam, while Tagawaura and Mitake-ike have intakes of over-flowing type. Judging from the drawing of warm water, the latter two are better than the former.

(7) 1~5 p.m is desirable for drawing irrigation water, but this shall be considered in connection with water depth and management of paddy fields after irrigation.

Beside the above mentioned research, it is quite necessary to investigate the relation between water amount to be drawn, reservoir capacity, reserved time of stored water in reservoirs and water temperature.

75. On land price and reclamation landowner undertakes. II. The study of the cost of land improvement. Kagato SHINZAWA (Rept. Land Section, Resources Council, Economic Stabilization Board, 1952)

Since the classical economists it has been considered that such capital invest-

ment as land improvement enterprises should be practised by agricultural lease-holders as farming capitalists, and has also been acknowledged that land owners who are at the same time agricultural managers should carry out the enterprises from the standpoint of agricultural capitalists with the exception of the enterprises to be practised by land owners.

Correcting the error of the above idea, the author demonstrated that it was quite legal that the land improvement enterprises should be undertaken by land owners. In other words, land owners have changed into loan capitalists with establishment of land price, especially of price of unreclaimed land, and they should undertake land improvement enterprises from their own standpoint.

76. Experimental investigation on the flow-motion of grains in hopper. Fusanobu SHOJI (Journ. Agr. Machin. Soc. **12** (3, 4), 1-10, 1951)

Grain processing machineries are often practising their circulating operation of grains by the help of a funnel-like hopper. This report treats experimentally the function of funnel-like hopper and the flowing mechanism of grains in it in the above case. The author employed such a two-dimensional funnel-like hopper in which three conditions of the width of orifice (S), the space between hopper walls (B) and the angle of inclination of the bottom plane (θ) are adjustable. Using unhulled and hulled rice, the author observed and took pictures of the flow motion of grains in the hopper through the glass wall, and could classify the flow motion within the hopper into 3 types of U-Type, V-Type and M-Type, on the basis of the experimental result.

U-Type shows a motion of grains in the hopper flowing down uniformly, V-Type appears only at the V-shaped part of the hopper and M-Type shows the mixed flow-motion of the above two types. Though these 3 types will be affected according to the relative conditions of θ, B, S of the apparatus of the experiment, and generally there exists a relation between them by which they are displaced in such a way as U→V→M.

The height of displacement point h of U→V is expressed by the following empirical formula according to the conditions of B and S.

$$h = m(B - S)$$

where m = coefficient due to θ and properties of grains employed.

Accordingly irregularity of circulation occurs in the process of V-shape motion which will cause partially finished processing.

In the process of the flow-motion of grains in the hopper almost the same relation exists in the three-dimensional hopper as in the two-dimensional one treated above. In short when grains are in flow motion, they generally show the flowing nature resembling fiuids and the displacement to V-Type or M-Type mentioned above is considered to resemble the out-flow vortex phenomenon of vortex pot and air cone in case of flowing-out of water from the orifice at the bottom of a hopper.

77. On actual status of farmers using cultivators in Kanto District. Fusanobu SHOJI (First Rept. Sci. Res. of Education Ministry, **36-51**, 1951, published by Kyushu Branch of Agr. Mach. Soc.)

A cultivator is one of the farm implements which have rapidly been popularized after the World War II. The author undertook to carry out a survey about the following items concerning 40 farmers and settlers' farm: Under what circum-

stances did they introduce the new implement and how are they using it?

According to the survey, the farmers who are employing the cultivators are all ownerfarmers whose farming area is more than 1.2 ha, and moreover, most of them are centering around paddy agriculture, with 2∼3 agricultural laborers. Accordingly cultivators are comparatively chiefly used in winter cropping.

Though the chief cause of the inducement of the cultivators is, of course, to meet the shortage of labor, it is worthy of our notice that most of the users of them are found among younger generations 20 to 30 years of age. They chiefly use the cultivators for cultivation and weeding, soil moving operation, etc., but at the same time they are admiring their effectiveness very much for labor saving and improvement of operation efficiency.

The number of cultivators induced in Kanto District by the end of 1950 reached about 30,000, but on the basis of the above result, it is expected that at least about 100,000 cultivators will be infiltrated among 13.5% of all the farm families in Kanto District in the future.

78. On survey and expansion of use of cultivators in Kanto District. Fusanobu SHOJI (Second Rept. Sci. Res. of Education Ministry, **81-97**, 1952, published by Kyushu Branch Agr. Machin. Soc.)

The use of the cultivators may be still more expanded by fixing various kinds of attachments to their frames. The use of the cultivators is now making a remarkable progress in Japan. The author made an actual survey of concerned farmers about this matter.

As the result, it was found that a cultivator has some defects which should be improved in order to expand the utilization of it. Not only the main beam of a cultivator, but also fixing of side beams of it, adjusting method of a shank, etc. had great defects. But farmers often made such attachments of their implements by their own devices, as a main beam of special type, a drag shoe, a marker, a rake, a press-tool, a small roller for barley, a furrower with long wings for tobacco farm, a cutting blade, a saw-toothed sweep, etc.

The author found that some farmers were applying ordinary attachments sold in the market in various ways, and thus the use of the cultivators was being expanded by such farmers as them.

The author discussed the expansion of the use of the cultivators by making such a general formula as below to compute how many methods (T) of uses are possible by combination of attachments.

$$T=[(N_1pqrs+1)(N_2pqrs+1)(N_3pr+1)-1]w$$

where N_1, N_2, N_3 = Number of different kinds of attachments which can be fixed in the front, in the middle and in the rear of the frame.

p, q, r, s = Adjustable number to acting depth, direction, forward and backward inclination, and lateral inclination of attachments.

w = Adjustable number to spacing between crops.

79. On mechanism of salt field. III. Ground water level and evaporation from sand surface of salt field. Jiro SUGI (Bull. Soc. Salt Sci. Japan **5** (4), 162-185, 1952)

If the ground water level of salt field is decided, water content of sand surface and the character of capillary water zone will also be determined by the physical characteristics of sand composing the ground.

In the experiment the author specially practised, stress was laid on the relation between the characteristics of the open and closed capillary water zones of sand layer and the evaporation from sand surface; in other words, instead of expressing the water content of the sand surface, the height of the sand surface above the ground-water level was taken as the standard in this new method.

(1) Water content and evaporation from sand surface.

Dried original sand of Tonami was put in glass dishes with sand layer 1 cm deep, and various kinds of water contents made by fresh water. After they were laid out-doors about 30 minutes, the diminished water amount due to evaporation was measured by weight method. The saturated state was reached at the point of 29.10% of the water content. Taking the point as 100%, little the change was perceived at 111.1% (over-saturated state) and 88.9~66.61%, but the result was lowered at 50%.

(2) Ground water level and evaporation from sand surface.

The evaporation from various heights upon a definite groundwater level and that from the free water surface 2 cm deep were measured and compared, which resulted as follows:

The sample was the original sand at Tonami, and the maximum height of the capillary water was as high as 37.1 cm, therefore 40~50% will be the boundary line between the open and closed capillary water zones. If we take the above percentage as 14.8~18.6 cm, No. 5 will be located near the above boundary line, and No. 6 and No. 7 belong to the sphere of the open capillary water zone. No. 1, No. 2 and No. 3 exist lower than the capillary water zone. The evaporation of the sand surface took place with a very good result, when ground water level existed at such a low level. Almost the same result as the above was obtained by the experiment practised on the salt field at Tonami, Miyagi Prefecture, in August.

(3) Salt collection effect due to evaporation of sand surfaces having different ground water levels.

The author checked if the above experimental result was effective from the standpoint of concentration, but not from that of evaporation, and practised the following experiment again:

A certain number of galvanized iron rings painted white were piled up, covered with oil paper to form a cylinder, stuffed with Tamagawa sand uniformly and laid in a container, in which capillary water was made to rise and evaporation to take place out-doors. Several sets were prepared and from every set the author gathered the samples from fixed points of height from the sand surface to groundwater level, and made quantitative analysis concerning Cl-ion, comparing the effects of concentration. As for the comparison of the evaporation from free water surface, a comparative experiment between there from various depths and Cl′ concentration in the experimental plot for evaporation from sand surface having various ground-water level was made. The result of this experiment nearly coincides with that made in the laboratory. In other words, the distribution of Cl-ion was in such a state that Cl′ had been adhered very much to the sand surface despite the depth of ground-water level.

At the points from 2 cm to 4 cm under the sand surface the concentration was a little higher than sea water, but at the lower points it was almost similar to the latter. However, the lower the ground-water level was, the better the collection of salt became, and in case ground-water level was high. Cl-ion concentration above

and under was almost equal. A comparative study between evaporation from free water surface and that through the medium of sand showed that the latter was better. However, when evaporation was great, higher level of ground-water was better, but when it was little, lower level showed a better result. In case it was dissolved by water deeper than 2 cm, brine of low concentration was obtained.

80. On mechanism of salt field. IV. Boundary between open and closed capillary zones. Jiro SUGI (Bull. Soc. Salt Sci. Japan **5** (6), 263-274, 1951)

The boundary between open and closed capillary water zones was investigated by such methods as pulling out method, heating method, pressure method and by observation of the atmospheric effect. As the result of this measurement no definite boundary line was to be drawn between closed and open capillary water zones, but in spite of the condition of sand it was found that the boundary would be located at about 40∼50% of the maximum rising height of capillary water from the underground water level, and this fact would be of much service in deciding the condition of evaporation from sand surface.

(1) Measurement by pulling out method.

A cylinder of 10 cm in diam. and 44.5 cm in height was filled with sand, and its apparent specific gravity was 1.5∼1.6. Keeping the depth of underground water 0.5 cm, the capillary water was made to rise. A glass tube 6 mm in diam. connected with a water pressure gauge at one end was put into the cylinder, and when the capillary water rose to its highest, the author pulled out the glass tube upward very slowly. When the tube reached a certain height, the gauge stopped to move, taking a horizontal state at the next moment. The ratio between the reading of the height at the time and the maximum rise of the capillary water was measured, which was 51.30% on an average.

(2) Measurement by heating or pressure method.

A glass cylinder of 4 cm in diam. and 100 cm in height was filled with a sample. The cylinder had small holes at 3 cm intervals, into which glass tubes 5 mm in diam. connected with a water pressure gauge by indiarubber tube at the other end were inserted, and a heliolamp (500 W) shed a light upon the rubber tubes in order to heat and expand air in the tube. And in case of the pressure method the author gave a press upon it with finger, by which the author could discern the changed or unchanged part by the gauge, and thus determine the boundary by the height between the above two phases. The heights in case of heating and pressure method were 53.4% and 41.4% on an average respectively.

(3) Observing method of atmospheric effect.

Cylinders of 15 cm in diam. and 52.5 cm in height were filled with different samples in order to make capillary water zones in them, and status of pressures of capillary water was observed.

The fact which was proved by this experiment to observe the boundary between changed and unchanged zones was as follows:

In case there existed a considerable space in the capillary water zone which was open to the atmosphere, both the ends of the water pressure gauges were considered to be under the similar conditions, and no change was perceived in the experimental measurement; but in case it was under a different state of the atmosphere, the change of the atmospheric condition brought about a delicate effect upon the

water pressure gauges. The change of the water pressure gauges were as follows:

The atmospheric and water temperatures both generally rose in the course of the hours between observations in the morning and afternoon, and the gauge showed a change of a similar tendency (+) with the temperature; on the contrary when an opposite tendency against the atmospheric pressure was shown it changed from (−) to (+) in accordance with high or low atmospheric pressure.

It was concluded after theoretical investigation that the boundary between the two zones existed at the point 33.3～47.1% and 40.2% on an average, and if correction is practised by the condition of measurement of the experiment, the value will become 49.8%, which will nearly coincide with the value actually measured.

81. Experiment on conservation of sloping cultivated land. Fujio YAMASAKI (Journ. Agr. Engin. Soc. Japan **19** (1), 1-8, 1951)

The author practised an experiment of a small scale on a sloping tertiary upland field in Kamo-machi, Niigata Pref. in order to investigate how much amount of rain water is checked, and in what degree soil erosion will take place.

No. 1 experimental farm is of clay soil and has a gentle slope of 9.5°, and No. 2 experimental farm is of loamy soil and has a slope of 31°. Each farm was divided into 4 plots, each of which was 8 m (longitudinal) × 2 m (transversal) in size. A wooden tank was provided at the lower side of every farm to catch drained water and eroded soil from the farm. Transversal furrows were made in the first plot, longitudinal furrows in the second and the third had furrows ploughed deep, and in these three plots sweet-potatoe was planted, while no crop was grown on the 4th, a bare plot.

The author carried out observation of the run-offs and eroded soil of the farms caused by the eleven heavy rainfalls from September 1949 to March 1951. The maximum rainfall during this period was 130.5 mm, duration of which reached 40 hours, and the next max. 97.0 mm, which had successive hours of 26.

The principal results of this experiment were as follows:

(1) Run-offs had a great correlation to the rainfalls, but a little one to intensity of rainfall.

(2) Comparison of the longitudinal, the transversal and the bare plot told that the last had the largest run-off and eroded soil, the longitudinal being next and the transversal having by far the least, which was only 10% compared with the longitudinal. The effect of the transversal furrows was larger than the author expected.

(3) Cropping had a great effect of minimizing of run-offs and eroded soil by protecting the ground surface.

Comparing the run-offs of the bare plot with those of the longitudinal, the author found that the latter had rather larger run-offs in the early period of the growing season, they decreased to fractional figures as the season advanced. No run-off and soil erosion were perceived during luxuriant growth of sweet-potatoe, even in case of such a heavy rainfall as 100 mm per day.

(4) It seemed that run-off was larger on a gentle slope area in case of little rain, and larger on a steep area in case of heavy rain.

(5) The bare plot had less water content in surface soil when it was compared with the cropped plots, and moreover, it decreased very rapidly with the continuation of fine weather. And it was perceived that in case of fine weather decrease of

water content was more rapid on the longitudinal furrow plot than in the transversal.

(6) Generally speaking production of sweet potatoe was larger on the lower part than on the higher part of the slope, and so in the transversal plot than in the longitudinal.

The following conclusion was reached from the above experiment:

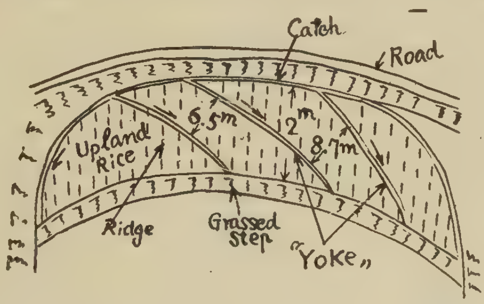
On the tertiary sloping upland fields in the neighborhood of Kamo-machi, Niigata Pref., a larger part of rainfall will be retained in the upland area, and no appreciable soil erosion takes place, if the transversal furrow system is adopted and a due regard paid to cover the ground surface with crops during the months of July, September and October in which heavy rains often fall.

82. An example of soil conservation method for farm land. Fujio YAMASAKI (Agr. and Hort. **26** (8), 1951)

A characteristic soil conservation method for farm land has been developed in Namino-Mura, Kumamoto Prefecture.

The village is located on the eastern slope of Mt. Aso, and the larger part of the farm land consists of sloping upland fields. The soil is composed of light volcanic ashes, which have little resistance against water erotion. Moreover, as the locality is often visited by heavy rains in summer, the ordinary cultivation is apt to invite a serious soil erosion. In order to defend soil erosion a soil conservation method called "Yoke" peculiar to this locality has been developed.

"Yoke" means small drainage ditches made obliquely on the upland fields having a gentle slope, (see Fig.) by which rain water will be checked and carried away



out of the upland area by slow velocity, and erosion prevented. "Yoke" is constructed by driving a plough drawn by draft cattle which is being employed in this locality now. The size of "Yoke" is as large as an ordinary furrow ditch. The distribution, spacing, shape of "Yoke" are different in each case, and a farmer who can construct suitable "Yoke" according to circumstances is called a full fledged farmer. If it is constructed in a wrong way, it is in danger of turning into a gully.

"Yoke" is a very effective method of soil conservation, when it is used with steps, catch canals, etc.

V. Fisheries

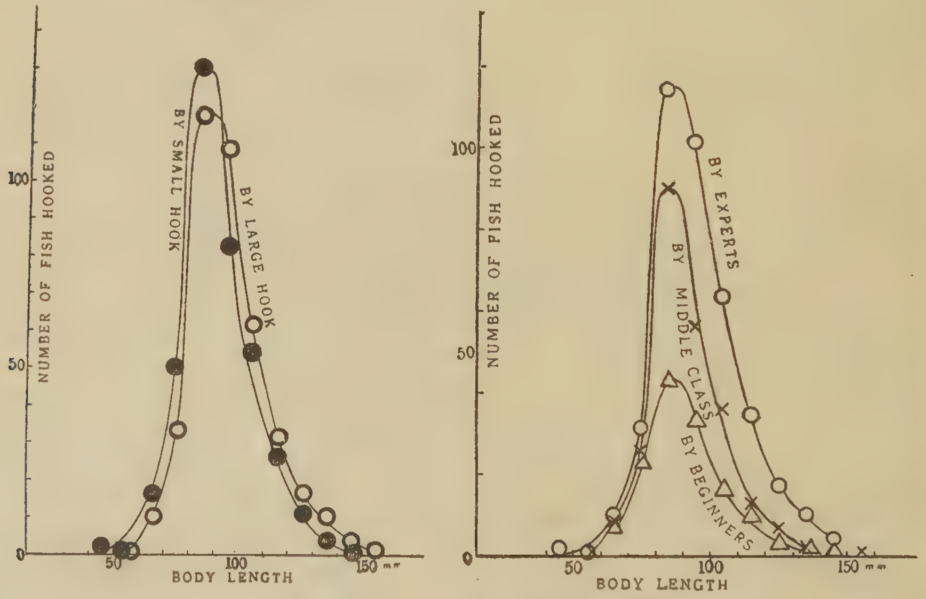
Abstracts Nos. 83—95

83. Size selection in fishing caused by size of hook and skill of angler. Yoshio HIYAMA, Takaya KUSAKA and Yukio NOSE (Jap. Journ. Ichth. 2 (3), 134-137, 1952)

The experiment was undertaken so as to see if the size of fishing hook and the skill of angler had effect upon the average size of the fish caught, *Acanthogobius flavimanus*, the Japanese Common Goby, a common game fish in Tokyo Bay.

The two sizes of hook, both the extremities of size of hook usually used for this bait fishing, were used by twelve anglers the skill of whom could be classified to the three degrees, (experts, middle class and beginners) according to their careers in sports fishing. All the anglers, on the same boat, fished at the same fishing ground, which was supposed to have the same group of fishes of the same size composition.

The sizes of the fishes caught by them were measured, and the figures were examined by a statistical method.



As it is clear even in the graphs of size distribution of the fishes caught, a remarkable difference of average size was found by the difference of size of hook used (Left). And by the difference of the degree of skill of the anglers some difference of the average size of the fishes caught was recognized between experts and others (Right).

84. Thermotaxis of eel fry in stage of ascending river month. Yoshio HIYAMA (Jap. Journ. Ichth. 2 (1), 23-30, 1952)

85. On the senses of food-searching in *Lateolabrax japonicus* (TEMMINCK et SCHLEGEL). Tamotsu TAMURA (Bull. Jap. Soc. Sci. Fish. **17**, 296-300, 1952)

The *Lateolabrax japonicus*, popularly called the Suzuki, is an important source of food for our people. It is generally believed that this fish lives on live fish and shrimp. That is why people fish for it with live bait.

I have carried on my experiments with young Suzukis (Body length from 4 to 4.6 cm), using for food the Medaka (*Oryzias ltipes*, B. L. 1-1.7 cm). I found first that in complete darkness the Suzuki is able to eat very few Medakas when these are few in number, and that the Suzuki is able to eat a sufficient amount when the Medakas are numerous. The results were the same when the Suzuki's eyes are removed.

I further found that a blinded Suzuki will not eat a dead Medaka at rest nearby. However if the dead Medaka is agitated slightly the Suzuki will devour it. I concluded therefore, from these experiments that the Suzuki either sees its prey or it senses the motion of the water and by this motion the position of its prey.

My next experiments were with normal Suzukis. I moved a dead Medaka back and forth a distance of 20 cm, varying the speed of the complete back and forth stroke between 4 seconds and 100 seconds. The stroke came from a reciprocating engine, which means that its speed was not uniform at all points. In this experiment I found that the Suzukis reacted to the presence of the Medakas at the following speeds, that is those of one complete stroke back and forth: 4 seconds, 15 seconds and 30 seconds. The Suzukis did not react at the following speeds: 60 seconds and 100 seconds. Neither did they react to a uniform motion in one direction, but, of course, they did react to a completely irregular motion.

In order to preclude the possibility of olfactory stimuli reaching the Suzukis, I cut off these stimuli and repeated the experiments. The results were the same.

My general conclusion are these: the Suzuki find their food mainly by visual movement perception; a Medaka at rest or moving in a linear, uniform motion has scarcely any food value for the Suzuki; the senses of olfaction and taste are not essential for the Suzukis' food-searching.

86. On the sexual maturity of the sperm whale *Physeter catodon* found in the adjacent waters of Japan (1). Masaharu NISHIWAKI and Takashi HIBIYA (Sci. Rep. Whales Research Institute **6**, 153-166, 1951)

87. The metamorphosis and growth of the larva of *Charybdis japonica* A. MILNE EDWARD. Ko YATSUZUKA (Bull. Jap. Soc. Sci. Fish. **17**, 353-358, 1952)

The artificial rearing of the larva of *Charybdis japonica* was carried out in the laboratory, and the author succeeded in rearing it through the metamorphosis from hatching to the youngest adult form crab.

The zoea larva was fed on the larva (morula and trochophora) of *Ostrea gigas* or on the nauplius larva of *Balanus amphitrite albicostatus*.

Zoeas moult 6 times, after which they become megalopas. The quickest zoea moults 6 times within 18 days at water temperature of from 27°C. to 30°C. in summer.

On the metamorphosis of zoea, the numeral increasing on the zoea-characteristic body parts and the development of megalopa-characteristic organs can be observed.

The growth coefficients of zoea of 2nd. and 3rd. moulting are higher than those of 1st., 4th. and 5th. moulting.

88. A simple method for the elimination of a slight chlorine gas in water. Yoshiyuki MATSUE and Yasuo ITAZAWA (Collecting and Breeding **13**, 241-244, 1951)

In our country chlorine gas is added generally to the city water for the purpose of water sterilization. We found about 1.5 mg/l of chlorine gas in tap water in Tokyo. The water can not be used directly as aquarium water because the gas has corrosive and injurious action to aquatic animals. Our experiments show that the fatal amount of the gas in water is 1.0 mg/l or less for fresh-water fishes such as gold fish and rice pad minnow (*Orizias latipes* (TEMM. et SCHL.)). Similar values are reported by previous investigators for many other aquatic animals. So, it must be required, for aquarium water use, that chlorine gas content of water should be less than 0.5 mg/l.

In order to eliminate or diminish the gas in water the authors tried several different methods and compared them and found that the absorption method with charcoal was the most suitable for the purpose. Merely, by pouring chlorine-gas-containing water (1.5 mg/l) through a small filtration vessel filled withh granurated charcoal we can get almost chlorine-free water at once.

The chlorine gas in water could be eliminated or diminished by other methods, e.g. by the aeration, by the boiling or by some chemical treatments, but such methods can not easily be applied to the treatment of much quantity of water in a short time.

89. Investigations on the origin of the shellfish poisons. Yoshiyuki MATSUE and Jiro KITTAKA (Journ. Fish. Res. Inst. **4**, 29-37, 1952)

Concerning the origin of the shellfish (*Ostraea* and *Venerupis*) poisons in Japan, various investigations and experiments have been carried out and still now being continued by many researchers, but the problem has not yet been cleared.

In this paper the authors report several negative results obtained by the experiments done upon the problem.

90. On the oceanographical conditions of Atsumi Bay (1934-1944). Aritsune SAEKI and Chisaburo YASUDA (Journ. Oceanogr. Soc. Jap. **7**, 14-19, 1951)

General oceanographical conditions of Atsumi Bay, Aichi Prefecture, were investigated on the basis of six serial observations taken between August 1943 and August 1944. And, as the characteristic features of the bay the following facts are indicated.

In the bay, there stagnates almost the same water mass all the year round. The distributions of pH and dissolved oxygen concentration of the water are almost identical in all layers and seasons. But in summer, when the surface layer is predominated by land water, very low values of dissolved oxygen concentration are sometimes observed at the thin layer in contact with the bottom. This remarkable phenomenon is considered to be the direct cause of the death of some useful bivalves (*Caspium muticum* REEVE et *Schizothaeisas nuttaili* (CONRAD)) inhabiting there. The phenomenon is called "NIGASHIO" or "bitter tide" by fishermen of Mikawa district, Aichi Pref.

91. Studies on the antioxidants for vitamin A enriched margarine. I. Takajiro MORI, Koji NAITO, Yasuo OZAWA and Hirosi KENBO (Journ. Jap. Soc. Food and Nutr. **4**, 105-109, 1951)

Various antioxidants were examined on their effects to protect vitamin A added

to margarine from oxidation.

(1) Ethyl- and butyl-gallates were considerably effective, but not suitable for practical use as they discolour the margarine.

(2) Vitamin C was inactive if alone, but effective as the synergist for phenolic type antioxidants.

(3) α-Tocopherol alone was also inactive as vitamin C and showed itself to be very powerful when combined with acid type synergists such as vitamin C, citric acid and others. α-Tocopherol with acid type synergists was more effective than N D G A (nordihydroguaiaretic acid) alone.

(4) When used separately, N D G A was most effective and ascorbyl stearate next.

(5) As the antioxidants tested changed their activities according to the kinds of raw oil, it seems that they should be added to margarine more than 0.01 per cent to ensure their effects.

92. On the antioxidants in wood-tar (I). Takajiro MORI and Koji NAITO (Journ. Jap. Soc. Food and Nutr. **4**, 179-182, 1951)

The wood-tar has been proved to be effective in preventing the fat oxidation of smoked fishes, and we tried to isolate the active fraction as antioxidant from it.

Irrespective of the wood species, the distillates from 260° to 280°C were most powerful. The antioxidant power of distillates varied according to the wood species, i.e., the tar from a broad-leaved tree gave the most active distillate, a needle-leaved tree next and pine-roots tar third.

The most active fraction of the broad-leaved tree tar obtained by distillation at from 280° to 286°C, were separated into 4 parts, namely, Na_2CO_3, KOH and H_2SO_4 extracts and the neutral residue. All parts were then redistillated. Among these distillates, the fraction of from 280° to 286°C of KOH extract was most powerful and showed 95 per cent of hydroquinone activity. However, the active component in these distillates has not yet been identified.

As the distillate is soluble in oils in any proportion and does not colour the oils, it is available as an antioxidant for non-edible oil and fat.

93. Comparative studies on the stomachal plates and crystalline style. I. On the enzymes of the stomachal plates in an Opisthobranch, *Dolabella scapula*. Yoshiro HASHIMOTO, Shoji MATSUMOTO and Takashi HIBIYA (Bull. Jap. Soc. Sci. Fish., **17** (2), 41-46, 1951)

The crystalline style present in lamellibranchs and a few gastropods, stands on an unique situation in the physiology of animal digestion. No other structure seems to be found in any animal origin except the style, which is a secreted mass and furnishes digestive enzymes to stomach cavity by the dissolution of itself. However, the authors found another case unexpectedly in the stomachal plates (or gastric teeth) in an Opisthobranch, *Dolabella scapula*. Several digestive enzymes were detected in the stomachal plates, whereas so far the trituration of the ingested foods has been considered as the only function of it.

In this paper, the results of studies on the enzymes contained in the plates are described.

Carbohydrases, such as cellulase, amylase, alginase, *Chondrus-slime* splitting enzyme and gelase were detected qualitatively in the plates extract. The presence

esterase and protease was also confirmed.

Amylase activity of the stomachal plates was similar to that of the crystalline style of *Meretrix luzoria*. Esterase of both the plates and style seemed to be the type of liver esterase, which hydrolyzes esters of simple alcohols more easily than fats. The protease in the plates was more active in alkaline medium than in neutral, and did not act on casein at pH 4.0.

94. **Studies on margarine enriched with vitamin A. (I) Effects of dye, flavor, hydrogenated oil and nickel salt on vitamin A oxidation in margarine.** Koji NAITO and Takajiro MORI (Vitamin **5** (3), 191-192, 1952)

Several factors affecting vitamin A oxidation in margarine were examined.

Yellow O.B., a colouring matter of margarine, has been considered to prevent the oxidation, but we recognized neither oxidant nor antioxidant effects of it.

Diacetyl, a main component of margarine flavors, was confirmed to be one of the vitamin A destroying factors, however, diacetyl did not cause any decrease of A potency of the margarine, when used with some other flavors.

Hydrogenated oils, especially nickel salts in them, were found to be considerably responsible for the vitamin A deterioration in margarine.

95. **Methionine contents of muscle proteins of various aquatic animals.** Fumio MATSUURA, Takeo KOGURE and Genji FUKUI (Bull. Jap. Soc. Sci. Fish. **17**, 359-362, 1952)

Methionine was determined by BAERNSTEIN's method in the muscle proteins from eighteen species of fish, two crustaceans, a mollusc and a whale. And also, the comparative determination of this amino acid in the proteins from the lateral line muscle (so-called "Chiai") and the ordinary muscle, was made in an individual body of several kinds of fish.

In fish-muscle proteins, methionine occurred within a fairly narrow range of values, from 2.56 to 4.83% on the moisture- and ash-free basis and they may be generally considered to be as rich as casein in this amino acid. However, the values for elasmobranchs were somewhat lower than those of the other fish tested.

The muscle proteins of the fish, which have the dark colored meat, seem to be higher in the methionine content than those of the white colored meat, and the protein of the lateral line muscle is higher than that of the ordinary muscle.

VI. Forestry

Abstracts Nos. 96 — 163

96. **On the White Grub damage and its control in the nursery. (No. 1).** Masatoshi NITTO and Kanji TACHIBANA (Tokyo Rinyu: Tokyo Regional Forestry Office **4** (2), 11, 1951)

Explanations of the real state of the White Grub damage in the nurseries of national forest were given with the results of investigations after surveying generally the present state of the nurseries.

In the first investigation we argued that the White Grub damage in the nurseries was overwhelmingly important compared with damage by others, disease, insects and weather (cf. Table 1), and that the distribution of White Grub covered whole the country. Consequently we put a particularly emphasis on the great significance of the control of White Grub.

In the second investigation, we asked directly the nurseries of national forest throughout whole country, how to control White Grubs, and we made a list of various control measures now under use.

The third investigation was concerning the damages inflicted upon the nurseries, and environmental factors were disposed and arranged statistically, and divided into several groups of nurseries in order to utilize as a datum for conducting fundamental investigation.

Table 1.

	The numbers of injured saplings	percentage
Needle blight	954,160	4.5
Damping off	1,956,320	9.1
Other fungi iniury	1,610,760	7.6
White Grub	4,814,910	22.5
Other insects injury	918,200	4.3
Animal injury (field mice, birds etc.)	392,270	1.8
Drought injury	9,785,110	45.8
Other weather injury	873,870	4.1
The others	80,250	0.3

(An explanatory note) Difference between drought and White Grub injury can not be recongnized exactly.

97. On the White Grub damage and its control in the nursery. (No. 2). Masatoshi NITTO and Kanji TACHIBANA (Tokyo Rinyu: Tokyo Regional Forestry Office **5** (1), 1951)

The results of the examination of the new insecticide D.D. were shown together with the experiments of D.D.T. and B.H.C.

These experiments were conducted in the Laboratory of Forest Zoology, Faculty of Agriculture, University of Tokyo, and afterwards in the SAMMYOJI Nursery belonging to Tokyo Regional Forestry Office.

The results of the fundamental experiment of D.D. for White Grub were clarified in the "Poisoning Curve" with the results of chlorpicrin and carbon disulphide adopted at the time for comparison.

The quantity of D.D. for killing mature larvae was decided as 2.5 cc per hole (arranged in "Chidori" type with 1 foot interval), and to eggs and immature larvae, the results were nearly the same. It is concluded that in both cases D.D. is superior to other fumigunts. From the results of the experiments concerning injury caused by D.D. for seedlings under various conditions, we found the following facts:

(1) As D.D. injures plants, this chemical should not be used on the beds where the saplings are growing.

(2) Plantation in the injected area should be avoided for 2 or 3 weeks after application of D.D.

An interim experiment was performed on the results of these fundamental experiments concerning D.D. and proved that this chemical was superior in efficacy and expenditure for practical purpose, too.

Examination of D.D.T. and B.H.C. on White Grub was tried, by inspecting mortality of the insects released in the soil which was mixed with those insecticides at various percentages.

From this test the appropriate amount of these insecticides for practical use was not decided, but it has supplied us with a valuable datum for the experiments in this nursery hereafter.

98. On the effect of fumigunt (D.D.) and repellents (naphtalene and paradichlorobenzene) for White Grub in NAGASAKA Nursery. Masatoshi NITTO and Kanji TACHIBANA (Sorin: Akita Regional Forestry Office **28**, 1951)

The aim of this experiment is the practical application of the results of the fundamental experiment concerning D.D., carried out by us in 1951, to the regions of different meteorological environments and soil conditions.

This experiment was performed in NAGASAKA Nursery, Yamuki-village, Mogami-gun, Yamagata Prefecture, by the two methods "latain square" and "semi practical interim experiment", then the results of it were examined according to "Analysis of variance". And the following results were obtained.

(1) The effectiveness of D.D. was determined indirectly by the percentage of saplings which were not injured by White Grub. When D.D. is injected in holes arranged in "Chidori" type, injection of 1.8 cc per hole is sufficient for the practical purpose though 3.6 cc is required to kill insects completely.

(2) Increase of both length and weight of saplings was found in the place where 3.6 cc of D.D. had been injected, while in the place injected 1.8 cc, only weight increase was perceived. These facts confirmed the growth-promoting effect of D.D.

(3) As for the repellent effects of D.D., it was impossible to confirm.

(4) Repellent effects were found in the dusting of repellents (naphtalene and paradichlorobenzene) on the surface of the ground at the frequency of five times at ten days' intervals during the term of oviposition and the quantity to be applied every time was 20 gr. per square meter.

In this case, the efficiency of dusting depends on frequency rather than on quantity of its application.

(5) Damage on seedlings of *Sugi* (*Cryptomeria japonica* D. DON) caused by repellents (naphtalene and paradichlorobenzene) was not found at all.

99. The warm-temperate forest vegetation of Oosumi Peninsula. Tokio SUZUKI (Bull. Tokyo Univ. Forests **41**, 57-73, 1951)

Oosumi Peninsula lies in the South of Kyûsyû, where one of the most excellent examples of the East-Asiatic broad-leaved evergreen climax is found.

1. *Machilus Thunbergii-Rumohra aristata* association SUZ.-Tok.
2. *Shiia Sieboldi-Rapanaea neriifolia* association SUZ.-Tok., nov.
3. *Distylium racemosum-Illicum anisatum* association SUZ.-Tok., nov.

The first association is situated in the coastal part below 150 m. The next occupies very narrow areas on spurs and ridges at low altitude. The last stretches wide between the altitude of 250 and 700 m. *Shiia*-type forest, (the second association)

has very restricted occurrences here, probably owing to the igneous nature of the underlying rock.

In this district the well-developed layer communities are no more than two, in spite of the absence of human disturbances. Toward the southern end, the precipitation becomes smaller, LANG's quotient (R/T) falling below 100. *Maqui*-type scrub of *Quercus phylliraeoides* or *Cycas revoluta* scrub takes the part of the high forest.

On the sandy beach, succession progresses in the following order, *Pinus*-type → *Pinus-Cyclobalanopsis*-type → *Machilus*-type (climax association of *Rumhreto-Machiletum* Thunbergii SUZ.-Tok. et HATIYA).

100. On the Heart-rot Fungus of *Tohi* (*Picea hondoensis* MAYR). Kiyowo AOSHIMA (Misc. Inf. Tokyo Univ. Forests 8, 89-95, 1952)

In the present paper the writer deals with the heart-rot of *Tôhi* (*Picea hondoensis* MAYR) distributed in the subalpine forests in Middle Honshu, Japan. *Tôhi*-tree is very prevalent and one-half of the standing trees are affected in some regions.

This heart-rot is confined to the stem of *Tôhi*-trees and the well-rotted wood shows typical white pockets, which are similar to those of *Karamatsu* (*Larix Kaempferii*) attacked by *Trametes pini* (THORE) FRIES.

The identification of the causal fungus and the cultural studies were made, and it has been clear that the causal fungus is completely the same with that of *Ezomatsu* (*Picea jezoensis*) reported in Hokkaido by YAMANO and afterwards by TOCHINAI et KAMEI, under the name of *Fomes jezoensis* (YAMANO) TOCHINAI et KAMEI.

Comparative studies of the several culture-strains of *Tôhi*-fungus, *Ezomatsu*-fungus, *Trametes pini* isolated from *Karamatsu*-wood in Japan and *Trametes pini* isolated in Europe were made.

The fungal mat of *Fomes jezoensis* is cottony and has abundant aerial mycelia. On the contrary, that of *Trametes pini* is felty and has little aerial mycelia. The mycelial growth of *Fomes jezoensis* is somewhat better at the lower temperature-range than that of *Trametes pini*.

In spite of the above mentioned differences, the writer suggests that the two fungi are closely related species through the fact that both the fungi has swellings in the mycelia cultured on agar media, which have never been found in any other species of *Formes*.

101. The white stem blight of trees in Japan, with 1 Plate. Tatsujiro ITO (Misc. Inf. Tokyo Univ. Forests 8, 79-87, 1952)

The white stem blight is called "Kempi-Byo" in Japan, and occurs in forests at the warm temperate zone. It attacks a number of forest trees and shrubs, and, up to the present time, 37 species in 21 different families have been listed as the host plants. It occurs mainly in young plants or branches, but the trunks reaching a foot in diameter are occasionally attacked, too.

The symptom of it appears on the surface of the bark covered with the silky white mycelial mat. The mycelial mat becomes larger and larger along the stems or branches and firmly attached to them. The mycelial strands run upon the mat. By and by, the part of the diseased tree above the portion covered with the mycelial mat is weakened noticeably and finally is led to death. The infected wood changes the color to pale purple, and then turns to yellowish. The blackish purple zone line is formed on the border of these two parts of different stages in rot. More decayed

wood is discolered to grayish white, and only the fibers remain in it. The infection of the desease is often caused by the touch of the injured plant to the sound one.

The fruit body is formed on the mycelial mat. At first the appearance of it resembles those of *Aleurodiscus spp.* and *Cyphella spp.*, but soon it adheres to the mycelial mat with its whole being under surface as those of *Corticium spp.* The color of the fruit body changes from pale yellow to yellowish brown. The upper surface is covered with the hymenium. The context of the fruit body is white, fleshy to waxy, and composed of the hyaline and branched hyphae, which have many septa and clamp connections. The basidia are clavate, 25-35 $\times$ 4.5-5.8 μ large, and have 4 sterigmata measuring 5-7 μ long. The spores are hyaline, smooth, fusiform-elliptical, and 7.0-8.5 $\times$ 3-4 μ large.

It has been mistakenly said that "*Kempi-Byo*" is caused by *Cyphella pulchra* B. and BR. in Japan. In India and Ceylon, *C. pulchra* grows on the tea bush as the common thread blight, but does not attack it. As the result of the morphological study on the causal fungus of the "*Kempi-Byo*", the fungus seems to be a speices of Genus *Cytidia* (QUELET). The specific name must be determined by further studies in future.

The mycelial growth of the fungus is favorable at the temperature near 28°C, and interrupted at 33°C.

The mycelial growth of the fungus is stimulated with a small quantity of tannic acid, but is gradually controlled with the increase in the amount of tannic acid.

According to the results of the experiments on the oxidase-reactions and the macroscopic appearances of decayed wood, this fungus seems to be one of the FALCK's Ligninzersetzer.

102. Anatomical studies on the wood of some *Fagus* Species, with 2 Plates. Ken SHIMAJI (Bull. Tokyo Univ. Forests **42**, 181-193, 1952)

Out of the ten species of Genus *Fagus*, *F. crenata* BLUME, *F. japonica* MAX., *F. grandifolia* EHRH., and *F. sylvatica* L. were studied wood-anatomically, and the descriptions of R. KANEHIRA on *F. Hayatae* PALIB. and N. YAMABAYASHI on *F. multinervis* NAKAI, being referred to, the wood-anatomical characteristics of six species were compared on a table. Besides, a key to the species based on the wood-anatomical characteristics was presented, although *F. Hayatae* was omitted from the key because R. KANEHIRA's description on that species was too brief.

The diameter ratio of wood fiber, by which the author means the ratio of diameters of wood fibers to those of their cavities, was the largest in *F. japonica*, decreasing in the order of *F. grandifolia*, *F. sylvatica*, and the smallest in *F. crenata*. The comparison of diameter ratio means the comparison of the quantity of cell-wall substances of wood fibers which constitute the ground mass of the wood, and from this standpoint, the above mentioned difference between *F. crenata* and *F. japonica* may be regarded as one of the reasons of the differences of specific gravities and other technological characteristics between the two species.

103. Decay durability of blue stained timber. Rokutaro TSUKIJI (Wood Industry **7** (3), 16-18, 1952)

In consequence of the 50 days' culture after inoculation, the test pieces of *Pinus denciflora* SIEB. et ZUCC. were stained in blue by *Ceratostomella ips* RUMB. The weight of these test pieces were not changed by staining.

These blue stained pieces were tested on the decay durability against four wood-rotting fungi, *Lenzites albida* FR., *Fomes pinicola* COOKE, *Polgporus volvatus* PECK, *Schizophyllum commune* FR. The decay durability of these blue stained timbers was the same as that of healthy timbers.

The filtrate from the culture-solution of *Ceratostomella ips* contains the substances that control the growth of mycelium of wood-rotting fungi. These substances are decomposed by heat, and this ability of control is weak.

104. On the absorption of water by seeds of *Larix Kaempferi* and *Pinus Thunbergii*. Ken-ichi HATANO (Jour. Jap. For. Soc. **33**, 426-430, 1951)

The seeds of *Larix Kaempferi* SARG. and *Pinus Thunbergii* PARL. absorb all over the surfaces of the seed-coats. For seeds to germinate, water of 116% in original weight on seven *Larix* seeds at 20°C, and that of 75% on nine *Pinus* seeds at 25°C are absorbed on the average. And then it was ascertained that the absorbing velocity of water (V.) changes through the following three phases till they germinate.

1) V. is very great.
2) V. changes hardly and is nearly zero.
3) V. is very great.

105. Wood-rotting fungi collected in the Tokyo University Forest in Hokkaido. Osamu CHIBA and Toshio TERAMOTO (Bull. Tokyo Univ. Forests **43**, 19-37, 1952)

An information concerning the occurrence and significance of decay, which may be encountered in the forest trees and lumbers of the Tokyo University Forest in Hokkaido, is presented in this paper.

According to the investigation of the sample plots, conifers in small diameter and deciduous trees in large are seriously damaged by various fungi. Especially, most of *Abies sachalinensis* MAST. and *A. Mayriana* MIYABE et KUDO in small diameter mixed with deciduous woods are decayed.

The most important fungi attacking living trees are as follows:

On conifers: *Phellinus Hartigii* (ALL.) IMAZ., *Phaeolus Schweinitzii* (FR.) PAT., *Cryptoderma Yanoi* IMAZ., *Phellinus nigrolimitatus* (ROM.) BOURD. et GALZ., *Onnia tomentosa* (FR.) KARST., *Stereum sanguinolentum* ALB. et SCHW., *Stereum abietinum* (PERS.) FR., *Poria subacida* (PECK) SACC.

On deciduous trees: *Fuscoporia obliqua* (PERS.) AOSHIMA, *Phellinus igniarius* (L. ex FR.) QUEL., *Hapalopirus croseus* (PERS.) DONK, *Laetiporus sulphureus* (BULL. ex FR.) BOND. et SING., *Phellinus dryadeus* (PERS.) MURR., *Inonotus hispidus* (BULL. ex FR.) KARST., *Fomitopsis ulmaria* (SOW.) BOND. et SING., *Cryptoderma Cercidiphyllum* IMAZ., *Elfvingia applanata* (PERS.) KARST., *Oxyporus populinus* (SCHUM. ex FR.) DONK, *Fomitopsis castanea* IMAZ., *Fomes fomentarius* (L. ex FR.) KICHX.

The important wood-rotting fungi attacking *ties* are as follows:

Tramtes Dickinsii BERK., *Tramates acuta* (BERK.) IMAZ., *Laetiporus sulphuleus* (BULL. ex FR.) BOND. et SING., *Trametes heteromeorpha* (FR.) LLOYD, *Gloeophyllum saepiarium* (WULF. ex FR.) KARTS.

Up to the present time, the identified species of wood-rotting fungi collected in this forest are 93 species in 40 different genera belonging to 6 families.

106. Tetrazolium salts as seed germination tests. Ken-ichi HATANO (Journ. Jap. For. Soc. **34**, 37-41, 1952)

Since LAKON used tetrazolium salts as seed germination indicators in 1942, the

reports related to these salts have increased rapidly. In this review, the writer emphasized the value of the new method with these salts for germination tests in Japan, comparing it with the old methods.

107. Ferns from Chiba Prefecture (1, 2). Satoru KURATA (Amatores Herbarii **44**, 3-4; **45**, 15-18, 1951)

As the climate of Bôsô Peninsula is warmer, its fern flora has many southern elements which are not to be found in the other parts of Kantô district. However it is a noticeable fact that a considerable number of warm temperate ferns which have their ranges from southern Japan via Izu Peninsula to the foot of mountains west and north of the plains of Kantô, are not at all or scarcely found in Bôsô Peninsula. For example, *Acystopteris japonica* NAKAI, *Asplenium normale* DON, *Dennstaedtia scabra* MOORE, *Glaphylopteris falciloba* H. ITO, *Loxogramme saziran* TAGAWA, *Ptilopteris Maximowiczii* HANCE *Pleurosoriopsis Makinoi* FOMIN, *Polypodium niponicum* METTENIUS, *Monachosorum flagellare* HAYATA, *Rumohra simplicior* CHING var. *major* H. ITO etc. have never been collected in Bôsô Peninsula and *Asplenium Sarelii* HOOKER, *Athyrium iseanum* ROSENSTOCK, *Diplazium nipponicum* TAGAWA, *Dryoathyrium unifurcatum* CHING var. *Okuboanum* (MAKINO), *Dryopteris Dickinsii* C. CHRISTENSEN, *Neoniphopsis linearifolia* NAKAI, *Rumohra amabilis* CHING, *Rumohra simplicior* CHING, *Vittaria flexuosa* FEÉ, *Hymenophllum barbatum* BAKER, *Mocodium polyanthos* COPEL. etc. are rarely found there, mainly at Mt. Kiyozumi, its neighbourhood and sometimes in one or two other localities. This type of fern distribution is inexplicable from the standpoint of climate (temperature and rain) nor from that of geological history. It is probably important factors that the fragile tertiary of Bôsô Peninsula renders the existence of some ferns critical or impossible, and because of the absence of large rivers and deep mountains, there are few topographies suitable for the life of ferns in Bôsô Peninsula.

108. On several floristic peculiarities of the Izu Peninsula. Satoru KURATA (Flowers and Plants **5**, 10-13, 1952)

Among many floristic peculiarities of the Izu Peninsula (Shizuoka Prefecture), the distribution of southern plants is specially discussed. Looking over the distribution of southern elements in Japan, there are many species which reach from the Kii Peninsula to the Izu Peninsula beyond the Sea of Tôtômi, not by way of Mikawa and Tôtômi Provinces. It is noticeable that many fern species specially become good examples for this type of distribution. This fact is to be explained by the climate of Prov. Izu warmer than that of Prov. Mikawa or Tôtômi and by the easier dissemination of fern spores. On the other hand, a considerable number of southern ligneous plants do not reach Prov. Izu, but have their easternmost habitats in Prov. Tôtômi or the western part of Prov. Suruga. Thinking of the warmer climate of Prov. Izu, this fact seems to be curious. But it is related to the geographical situation of Prov. Izu. As Prov. Izu is situated east of Prov. Tôtômi and moreover Suruga Bay intrudes northward between these two provinces, southern ligneous plants extending their ranges northward along the Japanese Archipelago, are refrained from arriving at Prov. Izu by deficiency of time or geographical and climatical discontinuity of these two provinces.

109. The orchids of Mt. Kiyozumi, Chiba Prefecture. Satoru KURATA (Misc. Inf. Tokyo Univ. Forests **8**, 73-78, 1951)

39 species of orchid family collected at Mt. Kiyozumi are enumerated. Based on the area of each species, it is explained that Orchidaceae of Mt. Kiyozumi are almost composed of warm temperate elements, as expected because of its warm climate.

110. The vegetation of the Tokyo University Forest in Hokkaido. Ryosuke KATO (Bull. Tokyo Univ. Forests 43, 1-18, 1952)

The data are all taken from the Tokyo University Forest in Hokkaido.

Fraxinus mandshurica-Syringa amurensis association is an edaphic climax restricted on the alluvium deposited along the valley, sometimes around the marsh. Its territory is suitable for exploitation, so that now we can find very few examples of the natural occurrence.

Abies Mayriana-Dryopteris crassirhizoma association is the climax below 700 m, covering the mountain-sides and valleys. This has two subassociations. The one, *Pirola* subassociation is widely distributed on the mountain-sides; while the other, *Carex* subassociation is restricted to the steeper slopes facing to the valley.

Picea jezoensis-Sasa kurilensis association is the climax of higher altitude, and occupies the large territory over the mountain-side and on the side-ridges, ranging between 700 m and 1200 m. This comes in contact with the alpine scrub vegetation of *Pinus pumila* at Mt. Dairoku, the highest peak in this university forest. Two subassociations are detected. The first, *Rumohra* subassociation is the typical part of the association; the second, *Betula* subassociation has restricted occurrences on the wind-swept tops of mountains or ridges.

The secondary succession was caused by fire progresses in the following sequence: *Sasa*-, *Salix*-, *Betula*-, *Quercus*-stages and finally *Abies*-type climax. The vast stretches of land in the climax area of *Abies-Dryopteris* association, are replaced by the *Betula Maximowicziana-Sasa paniculata* association.

Physiognomically, the climax forest is composed of evergreen coniferous life-forms: *Abies*-type for *Abies-Dryopteris* association and *Picea*-type for *Picea-Sasa* association. But decidious broad-leaved types like *Quercus*-type often invade into the canopy of *Abies-Dryopteris* association, and near the wood limit of Mt. Dairoku, *Picea jezoensis-Sasa kurilensis* association becomes more open and *Betula*-type takes the part of the dominant. The edaphic climax of the lowland is also consisted of a decidious life-form, *Fraxinus*-type. The most important vegetation type in the forest-floor, is *Sasa*-type, which is represented by two dominants, namely *Sasa paniculata* and *Sasa kurilensis*, *Abies-Dryopteris* association is inhabited by the former, while *Picea-Sasa* association by the latter. The dominance of *Sasa*-type forest-floor is determined by the density of canopies.

Either the yearly temperature (6°C after S. HONDA) or the continuance of the vegetative period (at least 4 with monthly mean above 10°C) cannot explain the absence of the *Fagus*-type climax in the lowland of the central Hokkaido. The severe winter, the coldest monthly average temperature being −10°C, and the yearly amplitude attaining as large as 30°C may be the cause of its absence. By the way, the writer offered in the previous work the index of warmth on the zero degree base, of 100 in the climatic minimum for the decidious climax. Here temperature ranges of each phytocoenosis both high and low are given by the indices of warmth and coolness on the zero degree base.

111. An ecological explanation of the southern range of *Abies Mayriana*

MIYABE et KUDO and *Picea jezoensis* CARRIERE in Hokkaido. Ryosuke KATOO (Bull. Tokyo Univ. Forests **41**, 33-42, 1951)

From the fact that the air temperature of 0°C seems to have a great significance for the seasonal change of osmotic pressure of cell-sap of northern coniferous trees which was measured, the author suggested one idea that it would be better to use 0°C as a standard of calculation of "the indices of accumulated temperature" in order to determine the boundary line between the distribution of temperate decidious forest and northern coniferous forest in Hokkaido. Especially it was closely connected with the southern limit line of northern coniferous forest.

According to the distribution maps of southern range of *Abies Mayriana* MIYABE et KUDO and *Picea jezoensis* CARRIERE, it is realized that the lines of "the index of warmth" 110° and "the index of coolness" −20° coincide with the southern range of *Abies Mayriana* and the lines of "the index of warmth" 100° and "the index of coolness" −10°, with the southern range of *Picea jezoensis*. However it is unable to find the close coincidence with the northern range of *Fagus crenata*, which is a typical species of temperate decidious forest. But *Castanea crenata* which belongs to the temperate decidious forest is not distributed over the line of "the index of warmth" 100°, so that the author recognized that the distribution line of "the index of warmth" 100° is suitable to indicate the boundary line between the distribution of temperate decidious forest and northern coniferous forest in Hokkaido, and that the zone, lying between "the index of warmth" 110° and 100°, can be regarded as "ecotone" from the temperate decidious forest to the northern coniferous forest.

112. Sociological study of *Chamaecyparis obtusa* forest and its Japan-sea elements. Teizo MAEDA (Miscellaneous Information. Tokyo Univ. Forests **8**, 21-44, 1951)

Chamaecyparis obtusa forest is an edaphic climax within the climax area of *Tsuga* and *Fagus*-type temperate climaxes in Japan, and *Chamaecypris obtusa-Rumohra mustica* association can be considered as an abstract unit, composed of two subassociations. The one, *Ilex Sugeroki* subassociation is differentiated by *Ilex Sugeroki* and other Japan-sea element; the other *Pieris japonica* subassociation contains *Pieris japonica* and other pacific elements as its differential species. And as many as 23 sociations are detected below them, which are grouped into the following nine forest cover types.

(1) *Sasa paniculata*-type, indicating well-differentiated soil.
(2) *Lycopodium serratum*-type, indicating transported soil in stabilizing process.
(3) *Carex Reinii*-type, indicating moorish soil state.
(4) *Fern*-type, somewhat heterogeneous, indicating acidic soil.
(5) *Moss*-type, indicating moorish soil.
(6) *Cephalotaxus nana*-type, indicating typical snowy climate.
(7) *Ilex Sugeroki*-type, indicating dry shallow soil on mountain ridge or soil around damp ground.
(8) *Rhododendorn Degronianum*-type, indicating shallow soil on mountain ridge.
(9) *Pieris japooica*-type, indicating typical Pacific climate, and often, soil on lava-flow or mountain ridge.

Climatically, it is suitable for the occurrence of *Chamaecyparis obtusa* forest that monthly rainfall in winter indicates about 100 mm or more. Edafically, it will be

possible to point out podosolized soil as the index to the occurrence of *Chamaecyparis obtusa* forest. And it will be quite impossible that decidious forest takes the place of this forest without an action of external power, because the podosolized soil of this forest is in progressed state compared with the brown forest soil of the decidious temperate climax. Consequently the writer is of other opinion than that of H. NAKANO who considered that the *Chamaecyparis* forest was rather an unsuitable community within the decidious temperate climax. Podosolization of soil is promoted not only by climate, but topographic condition and character of rock. It seems that podosolization in Kiso and Ura-Kiso is very much influenced by acidic rocks as granite, granite-porphyry and quartzporphyry presented on a large scale, in addition to the above-mentioned climate conditions.

113. Influence of nitrogen-, potassium-, or phosphate-deficient nutrient solution on the yield of root tubers and their alkaloid contents of *Stephania cephalanta* HAYATA by the water culture. Akira KAWANA (Bull. Tokyo Univ. Forests **41**, 43-46, 1951)

The influence of deficiency of the elements of N, K_2O, P_2O_5 in the nutrient solution on the yields of the root tubers and their total alkaloid content of *Stephania cephalanta* HAYATA was studied through the water culture.

(1) It is proved that the differences among the yields of the root tubers nursed in the control and nitrogen- potassium- or phosphate-deficient nutrient solutions are significant.

namely, the control $> -K_2O > -P_2O_5 > -N$

(2) It is recognized that the total alkaloid is the least in the root tubers cultured in the nitrogen deficient nutrient solution.

114. Studies on the vegetation of Chichibu mountain forest. (2) The plant communities of the temperate mountain zone. Teizo MAEDA and Jiro YOSHIOKA (Bull. Tokyo Univ. Forests **42**, 129-150, 1952)

This report is a vegetational survey on the temperate mountain zone of Chichibu mountains, continued from the last report.

a. Ridge.

(8) *Tsuga Sieboldii-Rhododendoon dilatatum* association.

This association has a place in the largest domain among associations existing on ridge of the temperate mountain zone.

(9) *Quercus crispula-Prenanthes acerifolia* association.

This association is successional community, and is divided into 7 sociations.

(10) *Chamecyparis obtusa-Pieris japonica* subassociation.

This subassociation, compared with *Tsuga Sieboldii* association, occupies rather moist ridge, and is divided into 3 forest cover types.

b. Mountain side.

(11) *Fagus crenata-Sasamorpha purpurascens* association.

This association is *Fagus* community of the Pacific type and differs essentially from that of Japan sea type. This is divided into 4 forest cover types and 8 sociations.

c. Ravine.

(12) *Fraxinus commemorales-Dryoters polylepis* association.

This association occupies mostly ravine of the temperate mountain zone and is divided into 8 forest cover types and 20 sociations.

(13) *Chamaecyparis pisifera-Ptllopteris Maximowiczii-Hylocomium bremiroste* association.

This association occupies rather higher land than Fraxinus commemoralis, and is divided into 2 forest cover types and 6 sociations.

115. The process of growth on the Chuoo-zan experiment plot of selection system in Tokyo University Forest in Hokkaido. Rokuroo KUNUGI (Misc. Inf. Tokyo Univ. Forests 8, 13-20, 1951)

The Chuoo-zan has passed 16 years since felling selection system (thinning ratio 20%, 40%, no thinning plot). The fifth periodic measurement was done on the increment and the dying tree volume in Oct. 1949. The results of measured process are the following:

(1) It is recognized that the change of growing stocks occures largely in some year and this tendency is common to all plots. Namely the standing stocks decrease in the year that dying trees come out at intervals, but after dying the increment tends to increase temporarily.

(2) The volume of dying trees on the non-thinning plot is larger than on the other plots.

(3) The growing stocks on the plot of thinning ratio 20% recovered in the 8th year after felling. Judging from the measured data of 16 years, the growing stocks at the 40% will recover in the 20th year.

(4) On every plot, the trees of small sizes (diameter, 10-30 cm) show the largest increment, those of large sizes (over 50 cm), the medium increment, and those of medium sizes (30-50), the smallest increment. The dying percentage of coniferous trees of medium sizes is a little greater than those of the others.

116. Edaphological study on Norway Spruce (*Picea excelsa* LINK) plantation in Tokyo University Forest in Hokkaido. Masami ASAHI (Bull. Tokyo Univ. Forests 41, 1-32, 1951)

An edaphological study has been made on Norway spruce (*Picea excelsa* LINK) plantations in Tokyo University Forest in Hokkaido. Physical or chemical properties of soil profiles on sample plots were observed.

According to the results obtained, it appeared that the distribution of total organic matter and its nature, and amounts of exchangeable Ca had important effects upon the condition of soil profiles, and fertility of stands, especially the distribution of organic matter in upper layer, amounts of exchangeable Ca or degree of Ca saturation and moisture at a sampled time brought about a marked infiuence on the growth of norway spruce.

117. The location and the velocity of entrance of water into the seeds of *Pinus Thunbergii* PARL.. Masasi GOO (Bull. Tokyo Univ. Forests 41, 51-56, 1951)

A study was made to determine the location and velocity of entrance of water into the seeds of *Pinus Thunbergii* PARL. during the first week in germination bed. The seeds were coated with paraffin in various ways. The increase in weight of seeds was determined with a torsion balance and the increase was regarded as caused by water absorption. As water was absorbed by them, provided that any part of seed-coat was left in contact with water, and the velocity of absorption was nearly proportional to the area in contact with water, it may be said that water can enter

through the surface of seedcoat. Though curves showing the change in weight of seeds seemed to be somewhat complicated, they can approximately be represented by an equation $y=ax^b$ for the first 1-2 days, when the first stage of the water absorption, which was reported by the author previously, took place. The velocity of entrance of water through the vental and dorsal side of untreated seeds showed no significant difference.

118. When cell division begins in the germinating seeds of *Pinus Thunbergii* PARL.? Masasi GOO (Journ. Jap. For. Soc. 34, 3, 1952)

Cytological changes occurring in the embryo of the seeds of *Pinus Thunbergii* PARL. were studied during germination. Cell division was observed in root initial, epicotyl, cotyledon, pith, procambium and cortex for the first time when water absorption in the seed reached about 26% of the original weight; shortly after then it was also observed in the root cap.

119. On the seasonal variation of the nutrient elements in *Sugi* (*Cryptomeria japonica* D. DON) and *Hinoki* (*Chamaecyparis obtusa* SIEB. et ZUCC.) seedlings. Aizi ANDO (Bull. Tokyo Univ. Forests 42, 151-161, 1952)

Experiments were designed to determine the monthly nutrient intake of the yearling seedlings of *Sugi* (*Cryptomeria japonica* D. DON) and *Hinoki* (*Chamaecyparis obtusa* S. et Z.). Seedlings were sampled from the nursery once a month from May to October. Dry weight and contents of ash, N, P_2O_5, K_2O and CaO in the shoot and root of the seedling were determined. Results obtained are as follows:

(1) Dry weight and stem diameter gradually increased until they ceased, and the increase was remarkable at the later part of the growing season, though elongation of shoot and root was negligible in August.

(2) Water contents of both species were the highest in June, then decreased gradually, and always higher in *Sugi* than in *Hinoki*.

(3) Ash contents of both species increased extremely at the later part of the growing season. Percentage of ash showed its maximum in May, and decreased afterwards, and it was higher in *Sugi* than in *Hinoki* and higher in root than in shoot.

(4) As to the nutrient intake, both species showed their maximum intake of N at the middle and later periods, P_2O_5 at the early and later periods, K_2O at the middle period, CaO at the later period of their growth.

(5) As to the tendency of percentages of the nutrient elements, N was the highest in August and the lowest in September, P_2O_5 and K_2O were the highest in May and then falled afterwards, and CaO was the highest during the middle period.

(6) In October, percentages of the nutrient elements of both species were shown in the following order: CaO, N, K_2O, P_2O_5. At that time, N, P_2O_5, and CaO were higher in *Hinoki* than in *Sugi*, though difference in K_2O was not distinct.

(7) Between shoot and root, P_2O_5, K_2O and CaO were higher in roots than in shoot, but N in shoots was somewhat higher than in roots. In May, moreover, extremely high percentages of P_2O_5 and K_2O were observed in roots.

120. On the contents of "Wasabi" (*Eutrema wasabi* MAXIM.) plant. Kenji KURITA and Aizi ANDO (Journ. Jap. For. Soc. 34, 160-161, 1952)

"*Wasabi*" (*Eutrema wasabi* MAXIM.) is a hydrophite that belongs to the *Cruciferae,* and is cultured and used as condiments in Japan. The contents of mineral

elements of leaf, root-stock and root of "*Wasabi*" plant (Variety "Daruma") were determined. The contents of mineral elements of dry matter were as follows: N:3.6%, P_2O_5:0.8%, K_2O:3.7%, SO_3:2.7%, CaO:1.0%, SiO_2:0.3%. Among the elements studied. Contents of ash and K_2O were higher in leaf and root than in root-stock.

121. The inhibiting effect of water extract from the branches of some trees on rooting of willow cuttings. Seizaemon SATOO (Journ. Jap. For. Soc. **34**, 187-188, 1952)

Rooting of willow (*Salix babylonica* L.) cuttings was inhibited by the water extract from the branches of chestnut (*Castanea crenata* SIEB. et ZUCC.) and willow (*S. babylonica* L.), but not inhibited by that from the branches of pine (*Piuus densiflora* SIEB. et ZUCC.).

122. Influence of Parent Cryptomeria trees upon the progeny. III. Growth of the progeny in plantation. Kentarô NAKAMURA, Taisitiroo SATOO and Masasi GOO (Bull. Tokyo Univ. Forests **43**, 39-47, 1952)

Open-pollinated progenies of 10 trees of *Cryptomoeria joponica* D. DON were planted individually in randomized arrangements on two plantations. Their height, diameter breast high, course of growth in diameter and height, amount of branches and needles, and stem growth per unit weight of branches and needles were compared when they were 20 years old. Progenies of trees in old stands showing excellent growth exceeded progenies of trees in young stand showing inferior growth, both in height and in diameter. Amount of branches and needles, stem growth per unit weight of branches, whirh were determined on sample trees, showed the same trend as height and diameter. Because these differences in growth and related characters are supposed to be hereditary, it is recommendable to avoid the use of seeds from inferior stands, even if seeds are more easily collected from them. The course of increment in height and diameter was compared on sample trees by means of stem analysis. There was no obvious difference between them in the early stage of growth, but the difference between the extremes became significant at the 13 the year for the first time. The rank of their height at the third, sixth, and 20th year showed an extreme discrepancy, suggesting that too early selection in progeny test is not recommendable.

123. Some aspects of growth in stands (a preliminary report)—An analysis on pine stands of different spacing. Syoozi SENDA, Kentarô NAKAMURA, Suemoto TAKAHARA and Taisitiroo SATOO (Bull. Tokyo Univ. Forests **43**, 49-57, 1952)

An analysis was made on stands of Japanese red pine (*Pinus densiflora* SIEB. et ZUCC.) in the Tokyo University Forest in Chiba. The stand studied consisted of four plots of different spacing, i.e., 0.5 m, 1.0 m, 1.5 m, and 2.0 m in the distance between trees. The plots were planted with one-year-old seedlings in 1938, and a survey was carried out in the autumn of 1950. Because the comparison of diameter shortly after the planting and that of height at the time of the survey showed no significant difference among the four plots, the site quality of each plot was presumed to be nearly equal. The average diameter breast high, size of crown, live crown ratio, stem volume, amount of needles per tree, and volume of branches per tree and per unit area decreased with the increasing stand density. The mortality, volume of stem and basal area at breast height per unit area, leaf efficiency, and

ratio of stem to total wood (stem plus branches) increased with the increasing stand density. The volume of total wood, amount of needles per unit area, and height were not affected by the stand density. From these results, it is concluded that the amount of wood produced by a young stand is not affected by stand density, but the percentage of stem in the produced wood is affected by stand density, provided that the stand is closed and site quality is equal.

124. The origin and development of adventitious roots in seedling cuttings of conifers (1). Seizaemon SATOO (Bull. Tokyo Univ. Forests **43**, 59-81, 1952)

The origin and development of adventitious roots were studied in cuttings of epicotylic shoots of young seedlings of 8 coniferous species. In *Cryptomeria japonica* adventitious roots arose from the primary ray tissues immediately below the leaf trace and from the callus tissues. Roots from ray tissues initiated in the cells of relatively outer part in the phloem region, and developed in nearly round masses of meristematic cells by the successive division of ray cells and adjacent phloem and cambium cells. Callus tissues developed from cambium and phloem at first, but later, also from cortex at the cut base or slightly above the cut base when the most part of parenchymatous tissues had been decayed. In parenchymatous callus tissues developed callus xylem in connection with newly formed xylem of stem, and then cambium-like cell layers were differentiated along them. Roots from callus developed from parenchymatous callus tissues, not yet differentiated to cambium-like layers, as a group of meristematic cells connecting with the differentiating callus xylem.

In *Chamaecyparis pisifera* roots developed from the primary ray tissues only. They originated nearly the same way as in the case of *Cryptomeria*, but in the later stage, the root primordia developed in rather elongated shape in radial direction as compared with *Cryptomeria*. No callus-roots were found.

Most of roots in *Thujopsis dolabrata* arose from callus tissues. Their origin and development were the same as in *Cryptomeria*. In only one instance, a root was found arising in connection with a leaf trace.

In *Thuja occidentalis* roots arose from the primary ray tissues and callus tissues. Roots from ray tissues originated in the same manner as in *Cryptomeria* and *Chamaecyparis*. But later, some of them developed as in the case of *Cryptomeria*, but the others as in the case of *Chamaecyparis*. The origin and development of callus-roots were the same as in the case of *Cryptomeria* and *Thujopsis*, but it was noticeable that some of these roots originated as larger groups of meristematic cells than in the cases of the other species.

In cuttings of *Abies firma*, *A. mayriana* and *Picea excelsa* most of adventitious roots arose from the irregularly arranged parenchymatous phloem layers connecting with newly formed xylem near the cut base. Some roots developed from callus tissues or from around leaf traces.

In *Taxodium distichum* roots arose from the callus tissues only in the same manner as in *Cryptomeria*, *Thujopsis*, *Thuja*, etc. But one of them developed from peripheric region of callus.

125. Changes of reserve foods in seeds of *Kuromatsu* (*Pinus Thunbergii* PARL.) during the course of germination. Masasi GOO and Ken'itiroo NEGISI (Bull. Tokyo Univ. Forests **43**, 83-89, 1952)

The changes in the amount of the reserve foods in the seed of *Kuromatsu* during

germination were studied. The germination was carried out in the germinator and the analyses for fats, total nitrogen, total sugars and starch were made at seven different stages in the course of germination. The reserves in the dormant seed consisted of fats and protein with small quantity of sugars and others. In the course of the germination the fats decreased in both the embryo and the endosperm. The most part of nitrogen moved from the endosperm to the embryo but its decrease in the entire seed was little. Although most changes occurred after the radicle appeared, a slight decrease in the contents of fats and an increase of total nitrogen were observed in the embryo during the first two days after the seeds were placed in a germinator. It is supposed that these changes are due to decomposition of fats in the embryo and movement of nitrogen from the endosperm. The course of decrease of the fats was similar to that of the nitrogen in the endosperm, and it suggested the existence of certain relations between them.

126. On the effects of fertilization on the nutrient contents in *Sugi* (*Cryptomeria japonica* D. DON) yearling seedlings. Aizi ANDO (Bull. Tokyo Univ. Forests **43**, 91-100, 1952)

An attempt was made to determine the effects of fertilization on the nutrient contents and their seasonal variation in *Sugi* (*Cryptomeria japonica* D. DON) yearling seedlings which were sampled once a month from August to November, from the seed-beds under three different conditions of nutrient supply. Contents of water, ash, N, P_2O_5, K_2O and CaO in shoots and roots of seedlings were determined. The results were as follows:

(1) At the end of the growing season, the content of each element in dry matter was within the following limits: Ash, 6.0-6.5%; N, 1.2-1.8%; P_2O_5, 0.3-0.4%, K_2O, 1.5-1.7%; CaO, 1.1-1.4%.

(2) In every element, the change in the contents according to various stages of growth was more remarkable than the effect of the quantity of ferilizer.

(3) The following tendencies were recognized to a certain degree:

(a) The contents of N and CaO increased with the application of fertilizer, but those of P_2O_5 did not distinctly change.

(b) Compared with the other elements, percentage of CaO varied the least, in respect to the season and fertilization.

(c) In every element the changes in the contents due to the different degrees of fertilization were the least in October.

(d) The application of fertilizer resulted in an increase of P_2O_5 content and a decrease of water and N contents in the root.

(e) In November, the quantity of nutrient elements in seedlings decreased in the following order; K_2O, N, CaO, P_2O_5. When much amount of fertilizer was applied, N was higher in content than K_2O.

(4) When fertilizer was applied, maximum intake of N was found in October, and that of P_2O_5 and K_2O in September.

(5) In the distribution of nutrient elements, a relative increase of P_2O_5, K_2O and CaO contents and a decrease of N content in the root were observed at the later period of the growing season. As the result of application of fertilizer, a relative increase of ash and K_2O contents and a decrease of water and N contents in the root were observed, while the change of CaO content was not found.

127. Sylvicultural value of white pine in Hokkaido. Nobukiyo TAKAHASHI (Misc. Inf. Tokyo Univ. Forests **8**, 1-12, 1951)

White pine has the next six superior characteristics.

(1) White pine conforms to the climate of Hokkaido.
(2) The growth is fast.
(3) The damage of rat attacks is very little.
(4) The adaptability for sites is large.
(5) The seedling cultivation is easy and the result of seedling for planting is very good.
(6) The utilization of the wood is wide.

I want to recommend it as a superior species for afforestation in Hokkaido.

128. On the snow-storm damage (14-15, Feb. 1951) in the University Forest, Chiba Prefecture. Yuji HOTTA, Taneo HIRATA (Misc. Inf. Tokyo Univ. Forests **8**, 45-55, 1951)

Judging from our observation of snow-storm damages (caused on 14-15. Feb. 1951) in Tokyo University Forest in Chiba (Chiba Prefecture), it is concluded that, (1) To snow-storm damages, stands on the leeward steep slope have an inclination to be most, and on ridge are least exposed, (2) On the concave slope between spurs except in the windward side they are also in danger and (3) *Chamaecyparis obtusa* is as much firmer than *Cryptomeria japonica* in this snow-stormy case as in mere stormy case.

129. Boring-test of structural timblers for their durability judgement. Seihei KATO and Minoru KAMIIZAKA (Bull. Tokyo Univ. Forests **42**, 163-179, 1952)

The authors devised an unique boring-test instrument, which enables the measurement of specific torque-energy of boring and carried out some fundamental experiments with 2 cm × 2 cm × 2 cm test-pieces mainly of *Tsuga*. The tests were performed with ordinary round steel bores attached to the instrument, the diameters of which being small enough that the bored holls might cause no effects on the strength of timbers when the tests were applied to the actual structural members.

Investigating the results of the experiments, the authors conclude that,

(1) Durability or grade of decaye of wooden structural members can be judged with considerable accuracy by the measurement of specific torque-energy of boring.
(2) It is more preferable to apply the torque-energy method than to measure weight decrease for the judgement of grade of decay on the view point of strength of structures.
(3) For application of the new boring method to the actual wooden members, use of 3 mm class bore, so far as it is allowable, may be more effective than that of bores with smaller diameters.
(4) If the principle of the testing instrument is applied to a portable type instrument of an adequate size and boring tests carried out on some important points of members, durability of any actual structure or dangerous conditions caused by decaying of wooden members can be presumed or judged with considerable accuracy and convenience.

130. The direct method of designing an open channel. Sadao OGIHARA (Bull. Tokyo Univ. Forests **43**, 167-174, 1952)

This paper explains a new idea for determining an open channel cross-section, which requires less time for calculation and may be called the "direct method". In the old "trial method" one has to follow the under-described procedure.

1. Estimation of a maximum discharge Q_e.
2. Assumption of cross-section A.
3. Calculation of hydraulic mean depth R from $R=A/P$ (P=wetted perimeter).
4. Calculation of mean velocity (of running water) V.
5. Calculation of discharge Q from $Q=AV$.
6. Check for safety.

The safety of the assumed cross-section must be checked in the following two ways:

(i) Q must not be smaller than Q_e so as to cause no overflow.

(ii) V must not be so large as to cause erosion.

In case where these checks fail, we have to go back to the assumption 2. Thus, the trial method requires a toilsome repetition.

The direct method does not require repetition as in the trial method, its procedure being as follows:

1. Estimation of a maximum discharge Q_e ....the same as that in the trial method.
2. Determination of limiting velocity V_l by using tables or formulas such as Wang's.
3. Calculation of hydraulic mean depth R by using proper formulas such as Bazin's.
4. Calculation of cross-sectional area A from $A=Q_e/V_l$.
5. Design of cross-section.

Since we have already had the values of A and R, it is much easier to design the cross-section as compared with the assumption in the trial method. Moreover, a direct solution can be made by a simple procedure for cross-section having a rectangular or trapezoidal shape.

131. Run-off coefficient as an index for comparing the water regulating function of watersheds. Yoichi NOGUCHI (Bull. Tokyo Univ. Forests **43**, 175-188, 1952)

First, a methodological discussion is made on the run-off coefficient as an index for comparing the water regulating function of watersheds. Then, various run-off coefficients obtained from the four watersheds called A, B, C and D located in the Tokyo Univ. Forest in Aichi are dealt with. The results of the study about the data during the 20 years from 1930 to 1949, are briefly summerized as follows:—

(1) The means of annual run-off coefficients of watersheds C, D are larger than those of A, B which have better forest conditions.

(2) Long term tendencies of run-off coefficients during two periods of high and low water are slightly decreasing, where a high water period ranges from July to October and a low water period, from December to March.

(3) The value of $\frac{\text{run-off coefficient during 4 months of low water}}{\text{run-off coefficient during 4 months of high water}}$ has increased in the watershed C alone where erosion control planting has been carried out.

(4) Coefficients of correlation between precipitation and run-off coefficient of a high water period are +0.79, +0.80, +0.85 and +0.84 for the watersheds A, B, C and D respectively. However, the differences among each other can not be significant according to "*t*" test.

(5) The effect of precipitation on run-off coefficient is larger in a high water period than in a low water period.

(6) Even in a high water period the effect of precipitation on run-off coefficient is smallest in the watershed A which has the best forest condition.

(7) The order of the four watersheds decided by the index of their apparent run-off coefficients in cases of over 100 mm rainfalls is A, B, C and D showing the same order decided by other indices.

132. A study of mud and rock flow in Konuma-mura, Kitasaku-gun, Nagano pref. Isao YAMAGUCHI (Misc. Inf. Toyko Univ. Forests **9**, 65-77, 1952)

As to the mud and rock flow in the Funagasawa, Konuma-mura, Nagano Prefecture on 5 Aug. 1950, the causes of its occurrence and expansion are summarized as follows:

The watershed of the Funagasawa consists mostly of lava and volcanic ashes produced by the eruption of Mt. Asama. It is now in the most accelerated stage of the normal erosion cycle. Other geological formations found in this area are andesite, agglomerate sand and gravel strate and humus. Andesite has large cracks and is easily broken along these cracks. Broken rocks of andesite, when carried by water, increase the destructive power of flood and are scattered in places on the stream bed.

In some parts of the up-stream area andesite is covered with thin layer of humus (0.5-1.5 meter deep) which suffers mostly from lateral erotion. In the mid-stream area agglomerate, sand and gravel strata lie beneath andesite. Since erosion is severe on these under layers, stream banks form nearly perpendicular walls.

Owing to weathering abrasion of many years, cones of debris have been formed in many spots along the banks of the stream. By the heavy rain on 5 Aug. 1950, these many cones collapsed into the stream helping the expansion of the torrent. Underground water gushes out at 3 places along the stream. Agglomerate and humus layers are very unstable when affected by underground water. The heavy rain caused a collapse of these ground into the stream. This caused the damming-up of the stream water. When the temporary dam thus made was broken, the stored water ran down at a time, increasing the amount of discharge several times as much as the amount estimated by ordinary calculation. In short, a collapse of andesite did nothing more than an increasing dynamic power of running water, but the weathered products of sand and gravel strata and agglomerate together with humus had a closer relation with the occurrence and expansion of the mud and rock flow.

133. Ecological studies on the qualities of the timber of "*Hinoki*", *Chamaecyparis obtusa* SIEB. et ZCCU. Physical and chemical properties. Toichi MIYOSHI (Bull. Tokyo Univ. Forests **40**, 1-217, 1951)

This paper deals with the physical and chemical properties of the timber of "*Hinoki*". The author ecologically studied them. The obtained results are as follows:

On making a comparison of the timber qualities of one species, the tree form must be observed first, and the aspect of the annual ring formation must be searched

secondly. The mean values of 36 standard specimens which are collected over Japan are as follows: Tree age is 180. Height is 23.48 m. Breast height diameter is 44 cm. Relative clear length is 0.55. Number of annual rings per 1 cm is 8.6. Relative volume (volume/tree age) is 1.21. And these values change with "Hinoki" temperature factor (A_1, A_2, B). The sapwood is pale yellowish white and the heartwood is light reddish brown. On the boundary of sap and heart, there is a white ring layer of 1.5-2.0 mm width. The width of sap is usually from 2.0 to 3.5 mm. The standard summerwood percentage of normal wood may be 7.0 when the number of rings per unit length is from 7 to 10. Young tree's summer wood percentage is larger than that of old ones, and it decreases in high and cold locality. The trees in high and cold locality have better quality than those of low and warm locality. (The author adopted the annual rings as the index of the quality of the timber.) The good quality wood indicates 9.0 in color tone and 1.05 in coefficient of color-quantity as a standard value by OSTWALD's apparatus. Differences of chemical composition are relatively small in relation to the locality which is indicated by the "Hinoki" temperature factor, to the tree age and to the number of rings per unit length. The specific gravity of the heart-wood of 36 specimens is 0.44 in air dry and 0.40 in oven dry. Its value is somewhat high at the tree base and decreases slightly with the height, but its variation is small. If the number of rings per unit length is 6.0-9.0 in the bole, it is almost uniform. Mechanical properties are as follows: Compressive strength is 467 Kg/cm^2 in air dry and 690 Kg/cm^2 in oven dry and these values are somewhat low at the base and almost similar from the breast height to the clear length, then increase towards the top. Tensile strength in air dry is 548 Kg/cm^2. Modulus of rupture in air dry is 694 Kg/cm^2. Shearing strength in air dry is 82.0 Kg/cm^2. On the view of clearing the excellency of the timber quality of "*Hinoki*", the number of annual rings per unit length may be a good index. All the timber properties are closely concerned with it. The standard values of the number are as follows with regard to localities which are indicated by the "*Hinoki*" temperature factor.

A_1	A_2	B
10.0	8.0	6.0

These indices may be useful for estimating timber and also for the silviculture of "*Hinoki*".

134. Effects of heat treatment on the mechanical properties of wood. Kakuichi KITAHARA and Masayuki CHUGENJI (Journ. Jap. For. Soc. **33**, 414-419, 1951)

In this experiment the changes of mechanical properties of wood by heat treatment in high temperature air were tested. The authors adopted absorbed energy in impact bending, Young's modulus and modulus of rupture in static bending as mechanical properties. The species used were *Hinoki* (*Chamaecyparis obtusa* SIEB. et ZUCC.) and *Buna* (*Fagus crenata* BLUME). The test pieces were heated at 150 and 200°C in electric thermostat. The durations of treatment were 1, 3, 5, 10 and 20 hours. The test pieces in testing of mechanical properties were in air dry condition. When the water content of test pieces is different, they calculated the values of absorbed energy, Young's modulus and modulus of rupture by next formulas.

absorbed energy,

Hinoki $K=17.3-0.263u+0.019u^2$ ($kg\text{-}cm/cm^3$)

Buna $K=29.2+0.498u+0.015u^2$ (")

Young's modulus,

Hinoki $E=9.7-0.14u(\times 10^{-4})$ (kg/cm²)

Buna $E=11.4-0.06u(\times 10^{-4})$ (,,)

modulus of rupture.

Hinoki $\sigma_B=556.4-12.05u$ (kg/cm²)

Buna $\sigma_B=678.7-15.29u$ (,,)

But these formulas were obtained by virgin wood.

The results are as follows:

1. The absorbed energy evidently decreases by heat treatment. For instance, the value decreases to 1/2 of that of virgin wood by the heat treatment of 5 hours at 150°C and 1 hour at 200°C, and to 1/5 by the treatment of 5 hours at 200°C.

2. The Young's modulus in bending is scarcely affected by the heat treatment of 5 hours at 150°C. But at 200°C the value of *Hinoki* increases by the same treatment. When the treating hour increases, the value decreases gradually. On the other hand, the value of Buna is scarcely affected even at 200°C. The reason of the increase of *Hinoki's* value has to be studied by a more precise test.

3. The modulus of rupture in bending is scarcely affected by the heat treatment of 5 hours at 150°C. But at 200°C, the value decreases to about 1/2 of that of virgin wood.

135. Studies on the cutting of circular saw. II. Experiments on the cutting friction between wood and saw blade. Yoshio SAITOO and Hisashi FUKUI (Trans. 59th Meeting Jap. Forestry Soc., 257-258, 1951)

With the intention of obtaining some data for investigating the causes of snaky sawing on circular saw cutting, the authors measured the power consumed by the friction between wood and saw blade as well as the told cutting power by wattmetre on several kinds of sawn board thickness.

Tested saw blades are 10-inch in diametre and have 72 teeth. Feed speed is 2.1 m/min and cutting speed is 8635 feet/min. Tested wood is *Sugi* (*Cryptomeria japonica* D. DON) and is air-dry. The results obtained are as follows:

(1) From 0 to 15 mm of sawn board thickness both the power consumed by friction and the total cutting power increase with sawn board thickness, and over 15 mm of this they become constant.

(2) Net cutting power (the difference between the total cutting power and the power consumed by friction) is constant independently of sawn board thickness.

From these results it is suggested that from 0 to 15 mm of sawn board thickness the compressive stress which circular saw blade suffers on the fixed side of wood is larger than that of sawn board side. So the saw blade in cutting tends to turn aside to sawn board side. We think that this is one of the causes of snaky sawing.

136. Studies on plywoods. IX. The changes of some physical properties of casein glue by heat treatment. Shinji HIRAI and Jun'ichi SAITÔ (Wood Industry 7, 266-267, 1952)

The gelatinized casein glues comprising NaOH and $Ca(OH)_2$ are heat-treated for 1 hour at the temperature of 40°, 60°, 80° and 100°C.

(1) The water absorption of the hardened gel piece of glue becomes lower with ascending temperature.

(2) The swelling and softening time of the hardened gel piece becomes longer with ascending temperature.

(3) The viscosity of 10% NaOH solution of the hardened gel powder becomes larger with ascending temperature.

(4) The above-mentioned changes are almost gradual and there is no remarkable distinction between the treating temperature under 60°C and that of over 80°C as seen in the case of the adhesive strength and the water-resistance of plywood in the former report.

137. Studies on the layer-woods. Shinji HIRAI (Bull. Tokyo Univ. Forests **41**, 85-181, 1951)

The author researched the preparing methods of the layer-woods (laminated woods with veneers) and their properties chiefly in the view point of industrial production.

(1) On the tree species of veneer: Several species which had hardly been used for manufacturing layer-wood were investigated. As the common properties of the layer-woods of conifers, the tensile strength is occasionally excellent, and the shearing strength and the adhesive strength are considerably low. As to the hardened layer-wood, the products of *Chamaecyparis obtusa*, *Pinus Thunbergii* and *Pinus densi-Thunbergii* are generally superior and those of *Picea jezoensis* and *Cryptomeria japonica* are inferior. The quality of the hardened layer-woods of *Betula platyphylla* and *Betula costata* are considerably inferior and that of *Betula Ermani* var. *subcordata* is almost similar to that of *Betura Maximowicziana* which is most generally used in our country. The products of *Machilus Thunbergii* is extremely inferior to those of *Betula*.

(2) On the adhesives: Three kinds of phenol-formaldehyde resin adhesives which are used for impregnation of veneers to prepare hardened layer-woods were compared. The water removal resin is superior in respect to the penetration into veneer and to the quality of produced article compared with the water-containing resin and the water-removed, neutralized one. Using the phenol-formaldehyde resin adhesives comprising melamine, the preparing temperature of the hardened layer-wood can be lowered from 130°-140°C to 100°C. The phenol-formaldehyde resin comprising vinyl-formal, the resin paper (Tego film) composed of phenol, cresol, formalin and furfural and the protein solutions of casein, soybean or peanut for the use of hot-pressing were respectively investigated as to the preparation of the normal or hardened layer-wood.

(3) On the combinations of veneer: Several normal and hardened layer-woods were prepared with various grain-combination of veneer, and their physical and mechanical properties were cleared in relation to the direction of grain.

(4) On the layer-wood of large dimensions: Various normal and hardened layer-woods of the size of practical use were prepared. In addition to the mechanical tests with the pieces of the standard size, the tensile strength with the large pieces (ca 2 m) were also carried out. The tensile strength of large test pieces are 50-91% of that of small ones. In the case of estimating the usuability of an article only by a test of small pieces, it is considered that the strength of the article as practical size is in proportion to the mean of the test values and it can be counted for about 60% of the latter. The effect of veneer-jointing was also referred to.

(5) On the layer-woods with particularly treated veneers: A layer-wood prepared with veneers which are compressed after applying the phenol-formaldehyde

resin by only clamping with head-blocks and bolts indicates intermediate qualities of the normal and the hardened layer-woods. A hardened layer-wood with veneers which mostly consist of summer wood of *Cryptomeria japonica* has good properties except the shearing and the adhesive strength, but such veneers cannot be produced on a large scale.

138. Ecological studies on the qualities of the timber of "*Hinoki*", *Chamaecyparis obtusa* SIEB. et ZUCC. General remarks. Toichi MIYOSHI (Bull. Tokyo Univ. Forests **42**, 1-128, 1952)

The author ecologically has studied the timber quality of "*Hinoki*" from the view-point of forest management since 1929.

"*Hinoki*" is distributed from Kyûshû district to Ôu district horizontally. Its vertical distribution is somewhat variable with geographical situation and in Kiso (Nagano Prefecture) it ranges from 200 m to 1600 m above the sea. The author divided these districts into 36 and collected 36 standard testing specimens and over the 300 supplementary specimens from these districts. He classified these habitats by the factors. As the factors he adopted the air temperature (A_1, A_2, B, C) and precipitation (α, β, γ), and was always thinking of them in all tests. "*Hinoki*" begins its growth when the mean of the maximum and the minimum air temperature of a day attains 15°C in spring and closes at the same temperature in autumn. The change of the increment is almost parallel to that of the temperature which is shown by the mean of the maximum and minimum of a day. By his anatomical research individual variations of the number, the size, the volume and the arrangement of xylem elements are always gradual and not extreme. Sometimes the variation of one element may cause the variation of others. It is not evidently indicated whether the species should be divided into two or more formae or types. There are some relations between the gross structure of the bark and that of the internal wood. The arrangement of the bast element is very regular and periodical, and this periodical arrangement may correspond to the width of annual rings. The defects give some influences upon the arrangement, the distribution, the shape, the volume and the structure of xylem elements. The chemical researches as to the ash, benzol extract, alcohol extract, benzol-alcohol extract, cold water extract, hot water extract, 1% NaOH extract and lignin were done. On the color of the heartwood, OSTWALD's apparatus was used. On the mechanical properties (compression, tension and bending) the values were compared. At the same time annual rings per unit length and specific gravity (air dry and oven dry) were measured. On clearing the excellency of timber quality of "*Hinoki*", the number of annual rings per unit length may be a good index. All the timber qualities are closely concerned with it. The standard values of the number are as follows with regard to localities which are indicated by the "*Hinoki*" temperature factors.

A_1	A_2	B
10.0	8.0	6.0

These indices may be useful for estimating timber and also for the silviculture of "*Hinoki*".

139. On the application of high-frequency heating to wood technology. Takashi YAMAMOTO (Bull. Tokyo Univ. Forests **39**, 183-228, 1952)

To study the high-frequency characteristics of wood, the present writer selected

Hinoki, *Makamba* and *Nara*, and examined the differences of dielectric constant, dielectric loss factor, dielectric power factor and conductivity, correlated with the species, specific gravity, moisture content and the direction of fibres, marrows and cutting lines of wood.

For the high-frequency generators for experimental purposes, the writer used No. 1 unit which had an output of about 60 W and frequency of 30-40 Mc, and this was used chiefly for the investigation into tuning and matching according to the variations of size and conductivity of test materials. No. 2 unit had an output of about 350 W and frequency of about 8.7 Mc; No. 3 unit had an output of about 1.2 kW and frequency of about 5 Mc; and No. 4 unit had an output of 20 kW and frequency of about 3-5 Mc: the writer used these generators for his experiments.

Utilizing the generation of heat of the material itself and the effect of selective heating, which are the characteristics of high-frequency, the writer made the fundamental study of gluing.

As for the experiments for industrial production purposes, he made experiments of gluing furniture materials and of manufacturing plywood and formed-plywood, and showed the valuableness of the application of high-frequecny in wood processing.

Then, the writer made the study of wood drying. Since all of the drying methods formerly prevalent were those of heating from outside, and wood is thermally a non-conductor, it took much time to raise the temperature inside wood. Moreover, there was a fear of causing defects, such as cracks, case-hardening, etc. Consequently, it took quite a long time to dry wood. But, thinking that the high-frequency heating method complemented by some appropriate device may not only remove their shortcomings in wood drying, but also shorten the drying hours remarkably, the writer made various experiments.

Thus in accordance with the results of the above-said fundamental research and the study of industrialization, he pointed out the following features of high-frequency wood drying;

(1) High-frequency power needed for high-frequency drying.

(2) Maximum high-frequency electric power intensity possible to be poured in.

(3) Adjustment of temperature and humidity surrounding the wood being dried.

Further, according to these factors, the writer prepared the method of calculating the high-frequency power sources in high-frequency drying, the drying room and the volume to be put in it for drying as well as the method of planning the drying schedule.

140. Wood study of *Acacia mollissima* WILLID. of Tokyo University Forest in Chiba (Chiba Prefecture). Shinji HIRAI and Kakuichi KITAHARA (Misc. Inf. Tokyo Univ. Forests **8**, 97-103, 1951)

This paper deals with physical and mechanical properties of the wood of *Acacia mollissima* WILLD. which was seeded in 1943 at Tokyo University Forest in Chiba (Chiba Prefecture) and felled in 1948. This stand was visited by a typhoon in 1948, and some trees were snapped by the wind. The average values of several characters are shown in the following table.

Property	Average value
Specific gravity	
Air dry	0.70
Oven dry	0.60
Compression parallel to grain	
Maximum crushing strength	498 kg/cm²
Partial compression perpendicular to grain	
Proportional limit	132 kg/cm²
Bending	
Modulus of rupture	1057 kg/cm²
Modulus of elasticity	11.8×10^{4} kg/cm²
Shear parallel to grain	
Maximum shearing strength	129 kg/cm²
Impact bending in Sharpy's type	
Absorbed energy	0.96 kg-m/cm²
Brinell hardness	
End face	6.86 kg/mm²
Edge grain face	3.27 kg/mm²
Flat grain face	3.73 kg/mm²

Average shrinkage per 1% of moisture content from air dry to oven dry based on dimensions when 15% of moisture content,

Tangential	0.35%
Radial	0.17%
Longitudinal	0.015%

(Mechanical tests were carried at air dry condition)

The compressive strength, the bending modulus of rupture and the shearing strength of damaged trees are inferior to those of undamaged ones.

141. Studies on bamboo. VIII. Adhesive strength of *Phyllostachys pubescens* MAGEL. in relation to cut face. Shinji HIRAI and Jiro OGAWARA (Bull. Tokyo Univ. Forests **43**, 159-166, 1952)

The adhesive strength of bamboo (*Phyllostachys pubescens* MAGEL) with urea-resin adhesives was examined in relation to faces which were cut successively from outer part to inner part of the culm, marking them A, B, C and D. The following results were obtained with three bamboo samples:

(1) The average values of the adhesive strength in all combinations of two faces show that B > A > C > D, and there are little differences between A and B or C and D.

(2) The roughness of faces measured by the touching needle apparatus shows a correlating tendency with the adhesive strength in that A, B are smooth and C, D are rough.

(3) The transition of hardness (by BRINELL's method) of faces which is considered an index of specific gravity, does not coincide with that of the adhesive strength, for the value of A is exceedingly large and those of B, C and D become succeedingly small.

(4) By the statistical examination of the differences in the means of the adhesive strength in the combinations of the same faces, there are significant differences

between A & D, B & C and B & D in all cases, and as a whole the differences between A & C and C &D do not seem to be evident and also there may be no significant difference between A & B.

(5) Considering the shearing strength of bamboo and the large percentages of wood failure in the faces of C and D in this experiment, the adhesive strength of C and D seems to be dominantly affected by the shearing of wood.

142. Studies on bamboo. VII. Stopping of pit pore in bamboo parenchyma cell and its effect on gas and liquid permeability into bamboo. Yasushi SUZUKI (Bull. Tokyo Univ. Forests **43**, 151-157, 1952)

The permeability of air and several kinds of liquids into dried bamboo strip (*Phyllostachys pubescens* MAGEL) was studied. The measurement of air quantity flowing out from the bamboo specimen by a pressure drop of the surrounding air showed that about 70% of void volume of bamboo is closing against the surrounding air and is insensible to its pressure change. This fact can be considered in connection with the permeability test by carbon tetrachloride into the bamboo strip. This liquid could only be filled in bamboo at most about 30% of its void, that is to say, the residual void closes against the liquid. This abnormal closing is conceived to be caused by parenchyma cell, fundamental constituent of bamboo, its pit pore being stopped with its own dried cell sap when water is removed. For this reason, air or such liquid as is not able to pass through or not able to dissolve the dried sap membrane cannot permeate into parenchyma cell cavity while the liquid that is dissolvent of dried sap, i.e. water, can permeate easily into its cavity. From these results, it may be said that the air suction from dried bamboo such as in case of preservative treatment is meaningless with respect to parenchyma cell and that relative easiness of liquid impregnation has much relationship with solubility of dried sap in it.

143. Studies on plywoods. VIII. The effect of the drying-process on the adhesive strength of casein-plywood. Shinji HIRAI and Jun'ichi SATÔ (Wood Industry 7, 220-223, 1952)

The adhesive strength of casein plywood changes by the drying condition.

(1) The adhesive strength indicates the maximum value at the point of 10% moisture content, and this fact is invariable with the drying temperature. The higher temperature is, the higher the maximum value is.

(2) The low adhesive strength due to excessive drying under 10% almost recovers by absorption of moisture for a short time, but the maximum value in the absorbing process is lower than that in the drying process.

(3) The adhesive strength and the water-resistance of plywood are improved by drying at 80° and 100°C, but there is no effect at 40° and 60°C. When the plywood is dried for over 1 hour at high temperature, the water resistance tends to be lower than when it is dried more gently.

144. Effects of the radius of loading point and support on the bending properties of hardened fiber-board. Kakuichi KITAHARA (Misc. Inf. Tokyo Univ. Forests, 8, 105-112, 1951)

Effects of the radius of loading point and support on the bending properties, viz. YOUNG's modulus and modulus of rupture, of hardened fiber-board were studied by the center loading method.

The hardened fiber-board is made of ground pulp and its properties were as follows: Specific gravity in air dry was 1.49, that in oven dry is 1.36, water content 10% and Brinnell hardness 4.5 Kg/mm^2.

In the test, the radius of loading point being changed from 0 mm to 18.9 mm and that of support kept constant, the effects are not recognized. The reason for this lies in that the span is 150 mm, so the radius of elastic curve of the middle point of the test piece is always larger than that of loading point and the surface damage of the test piece does not occur by the rupturing load. But in the next test, the radius of support being changed from 0 mm to 25 mm and that of loading point kept constant, the effects of the radius of support on the YOUNG's modulus and the modulus of rupture are indicated by a minimum curve. When the radius is 0 mm, the edges of the supports stick to the mark of the test piece printed by meshes of metal net, and both the ends of the test piece are not completely free, so the YOUNG's modulus and the modulus of rupture have larger values than those of it of free ends. On the other hand, when the radius becomes too large the span of the loaded test piece decreases, but the span is not changed in the formula of calculating YOUNG's modulus and the modulus of rupture. After all their values increase.

So when we compare the bending properties tested by a different radius of support, we have to calculate the true span and deflection from the seeming values of them by the next formulae.

$$M=\left(\frac{l}{2}-x\right)\frac{P}{2}+y\frac{P}{2}\tan\alpha \qquad \text{(M : maximum moment)}$$

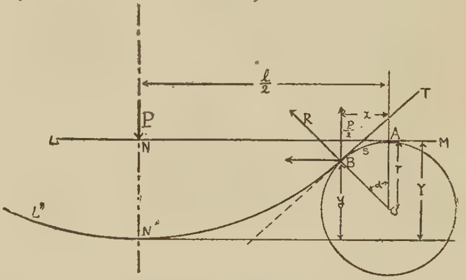
$$x=\int_0^s \cos\frac{\alpha}{2}\,ds$$

$$y=Y-\int_0^s \sin\frac{\alpha}{2}\,ds$$

$$ds=r\cdot d\alpha$$

$$\alpha=\frac{3}{l}y$$

$$Y-\frac{l}{3}\alpha=r\left(1-\cos\frac{\alpha}{2}\right)$$



145. Studies on hardened fiber-boards. VII. Beating condition in the manufacturing of ground wood fiber-boards by wet process. Michio MII (Wood Industry 6, 350-353, 1951)

In this report beating condition of ground wood (*Pinus densiflora* SIEB. et ZUCC.) for the purpose of making hardened fiber-boards by wet process is studied. The most adequate degree of beating (SCHOPPER-RIEGLER) is 41～58. In beating ground wood the strength of the fiber itself is weakened but the sheet-making power is strengthened by the improvement of colloidal quality. Owing to these opposing factors, the most adequate degree of beating for the mechanical and hygroscopic qualities can exist, but the value itself is variable with the kinds of pulp and other factors.

146. Studies on hardened fiber-boards. IX. Chemical treatments of ground wood fiber-boards by wet process. Michio MII (Wood Industry 6, 459-462, 1951)

In order to obtain the substitute for rosin soap and paraffin as the water-proofing reagents of ground wood fiber-boards by wet process, 14 kinds of chemical treatments (aluminum acetate, rosin soap, urea-formaldehyde resin, tar of pine root, sodium

alginate with sodium oleate, rosin soap with paraffin, rice oil soap with paraffin, sodium silicate, furtural, anilin, casein, animal glue, egg albumine, rice oil soap) were tested. Sodium alginate with sodium oleate gave the best mechanical and hygroscopic qualities, but owing to its high cost it cannot be the substitute. Tar of pine root and rice oil soap gave almost the same qualities as rosin soap and paraffin, and they do not give unpleasant stains when 1-2% of ground wood is added to them and their costs are low, so they can be used as the substitutes for rosin soap and paraffin.

147. The relation among time, temperature of alkali-cellulose aging and joint strength of viscose adhesive. Tomoichiro NAKATSUKA (Journ. Jap. For. Soc. **33**, 341-342, 1951)

It is recognised that the relation among time, temperature of alkali-cellulose aging and joint strength of viscose adhesive may be expressed by the following empirical formula.

$$\log F = \log a - 0.4343\, p\, \theta^{q}\, t$$

where F is joint strength of the adhesive, t and θ are time and temperature of alkali-cellulose aging, respectively, and a, p and q are empirical constants.

148. Ripening of viscose-adhesive. I. The influence of temperature and time of viscose-ripening on the properties of adhesive. Tomoichiro NAKATSUKA (Journ. Jap. For. Soc. **33**, 334-336, 1951)

(1) Joint strength of viscose-wood-adhesive decreases with ripening of viscose, and at low temperature the decreasing is slow.

(2) The relation among salt point (N), time (t) and absolute temperature of ripening (T) is expressed by the following empirical formulae.

$$N = ae^{-bt} \quad \text{and} \quad b = pe^{-q/T}$$

where a, b, p and q are empirical constants, and e is the base of natural logarithm.

149. Ripening of viscose-adhesive. II. The influence of addition of alcohols and other chemicals on ripening and joint strength of viscose. Tomoichiro NAKATSUKA (Journ. Jap. For. Soc. **33**, 397-400, 1951)

The influence of addition of chemicals on the ripening process and joint strength of viscose-adhesive was examined. The chemicals added were methanol, ethanol, ethylene glycol, glycerol, grape sugar, cane sugar, starch, phenol, acetone, dioxan and pyridine. No influence was recognized in the cases of acetone and dioxan. An addition of pyridine retarded the ripening slightly, but not remarkably. Alcohols accerelated the ripening and the order of influence was glycerol > ethylene glycol > grape sugar > methanol > ethanol > starch, cane sugar > phenol. The acceleration of the ripening by glycerol, ethylene glycol and grape sugar was remarkable. It was obviously observed that the decreasing of joint strength with viscose-adhesive was accelerated by the addition of the chemicals which accelerated ripening of viscose. In the case of the chemicals which did not influence the ripening the change of joint strength was the same as that of the control.

150. Ripening of viscose-adhesive. III. Syneresis of viscose-gel. Tomoichiro NAKATSUKA (Journ. Jap. For. Soc. **33**, 411-412, 1951)

The influence of addition of chemicals to viscose on the syneresis of viscose-gel is examined. The chemicals added are glycerol, ethylene glycol, grape sugar,

methanol, ethanol, pyridine and acetone. Although at an early stage of syneresis the quantity of syneretic liquid is slightly increased by addition of chemicals, the total quantity after long standing is almost the same as that of the control. In the case of grape sugar and acetone, however, the total quantity of syneretic liquid increases slightly, compared with the control.

151. Studies on pigments in fungi. (1) On the distribution of thelephoric acid in fungi. Maki SAWADA (Journ. Jap. For. Soc. **34**, 110-113, 1952)

Thelephoric acid was obtained from the fruit-bodies of four species of *Hydnum* (*H. aspratum* BERK., *H. graveolens* FR., *H. imbricatum* (L.) FR. and *H. scabrosum* FR.) and newly found from the fruit-bodies of two other genera, *Polystictus* and *Cantharellus* (*Polystictus versicolor* (L.) FR. and *Cantharellus multiplex* UNDERW.).

152. The influence of aeration on the water-culture of *Cinnamomum Camphora* SIEB. (II). The amount of oxygen absorbed by the roots of seedlings. Takeo SHIBAMOTO and Akira KAWANA (Bull. Tokyo Univ. Forests **43**, 101-104, 1952)

Measurements were made on the amount of oxygen absorbed by the roots of seedlings of *Pinus densiflora* SIEB. et ZUCC., *Cryptomeria japonica* D. DON., *Cinnamomum Camphora* SIEB. and *Zelkowa serrata* MAKINO cultured in nutrient solution.

When the leaves were exposed to the sunlight, no difference was recognized between the roots in nutrient solution and those in distilled water.

Whether the leaves were kept in the darkness or not, the seedlings under study did not show any difference of the rate of respiration in nutrient solution, except *Relkowa serrata* which respirated more in the former.

In all treatments, the differences of respiration were noticed in connection with the species, and the camphortree ranked the greatest.

153. Studies on the scheme of decomposition of oxalic acid by some wood-rotting fungi, and its effect on the change of pH in a glucose malt extract medium. Takeo SHIBAMOTO, Toshio FUKUZUMI and Rinhachi YANAGAWA (Bull. Tokyo Univ. Forests **43**, 105-110, 1952)

(1) O_2 uptake and CO_2 output in the oxalic acid solution were measured with the three wood-rotting fungi; *Schizophillum commune* FR., *Cortinellus edodes* (BERK.) SAWADA, *Poria vaporaria* FR.

(2) It was revealed that *Schizophillum commune* FR. decomposed the oxalic acid to formic acid and CO_2.

(3) Relationship between the reversal in the direction of pH change in the medium and the decomposition of oxalic acid was investigated.

154. Studies on antagonism of "*Shiitake*" *Cortinellus edodes* (BERK.) SAWADA against wood-rotting fungi. Inosuke IWADE, Toshio FUKUZUMI and Rinhachi YANAGAWA (Bull. Tokyo Univ. Forests **43**, 111-126, 1952)

Antagonism was observed between "*Shiitake*" *Cortinellus edodes* (BERK.) SAWADA and the other wood-rotting fungi propagated on various mediums; saw dust, glucose malt extract agar. Especially against *Stereum umbrinum* B. et C., *Cortinellus edodes* made a distinct zone line. In relation to pH of the medium, it may be concluded that the antagonistic function of *Cortinellus edodes* against the other wood-rotting fungi is max. when pH is ca 3.6.

155. Studies on carbonization of wood. (XII). On the effect of movable iron sheet barrier on charcoal making with the *Kiyosumi Earthen Kiln G-type* (*The Kiyosumi Earthen Kiln G 2-type*). Takeo SHIBAMOTO and Akira KAWANA (Bull. Tokyo Univ. Forests **43**, 127-138, 1952)

Some experiments of charcoal making were carried out in Tokyo University Forests in Chiba, by fixing a movable iron sheet barrier to the *Kiyosumi Earthen Kiln G-type*. This new type kiln is called *Kiyosumi Earthen Kiln G 2-type* for the convenience of study and propagation, because the following advantages were recognized:

(1) The length of time necessary for preliminary heat drying of wood is shortened, and a certain amount of fuel for the above purpose is saved.

(2) The control of breaking out of exothermic carbonization is easier, the time, therefore, is shortened, and the carbonization proceeds much more favourably.

(3) The total time needed for charcoal making is shortened.

(4) The yield of charcoal is very high.

(5) Charcoal of better quality not showing much difference in property between the top and the bottom is produced.

(6) The kiln, like *Kiyosumi Earthen Kiln G-type* is simple and easy to build.

156. Studies on carbonization of wood. (IX) Thermal decpmoosition of *Quercus glauca* and its methanol-lignin. Takeo SHIBAMOTO, Kyoji MINAMI and Kenjiro ENDO (Journ. Jap. For. Soc. **34**, 48-52, 1952)

The yield of acetic acid from the methanol-lignin was 0.85% of absolutely dry sample and this value was almost similar to those in literatures. Therefore our idea that lignin must be the main source of acetic acid in wood distillation was denied.

However, some interesting facts as following were known:

(1) Considered on the changes of concentration of acid and methoxyl group in the distillate, the course of thermal decomposition of wood over 320° was almost analogous to that of lignin, which agreed with the observation by Ochi and his collaborators.

(2) Much of acid was produced at lower temperatures than 260° and to account for this fact certain experiments has been considered and shall be examined in the near future.

(3) An other noteworthy fact casually known was that the methoxyl yield in the distillate of methanol-lignin was unexpectedly high in the lower fraction than 160°. This means an existence of a quantity of loosely combined methoxyl group.

(4) Though the measurement of volume of gas was not done smoothly and only successful in the case of methanol-lignin, the change of the volume of evolved gas paralleled to that of the amount of distillate.

(5) The residue of methanol-lignin (i.e. charcoal) was a porous, glossy, and pitch-like lump.

157. Studies on carbonization of wood. (X). Thermal decomposition of the wood of *Quercus glauca* and its lignins. Takeo SHIBAMOTO, Kyoji MINAMI and Tadao KODAMA (Journ. Jap. For. Soc. **34**, 77-82, 1952)

(1) The destructive distillations of the wood of *Quercus glauca*, its methanol-lignin and its hydrochloric acid-lignin were carried out.

(2) As acid, besides total acid, volatile acid was determined, differing from the previous paper.

(3) The results of the distillation of the wood and the methanol-lignin were almost the same as those in the previous paper, and confirmed the fact reported before. Namely, (a) the yield of acid in the case of methanol-lignin was so little that lignin could not be the main source of acid in wood-distillation; (b) In the case of wood, the yield of acid in the fractions lower than 260° was high; (c) In the case of methanol-lignin, the amount of methoxyl group in the lower fractions was very high.

(4) The content of volatile acid approximately resembled that of total acid and unexpectedly high in the higher fractions.

(5) In comparison of the results on the distillations of the methanol-lignin and the hydrochloric acid-lignin, the followings may be said. In acid, results of them were almost the same. The course of thermal decomposition was similar in both. In methoxyl group, its total distilled amount in the former was naturally very larger than in the latter, and in the change of methoxyl content, the former had a maximum in the lower fractions and the maximum in the higher fractions than 300° was well agreed in both. The residue of the former was a glossy black, porous and pitch-like lump while that of the latter was a non-glossy black powder.

(6) The maximum of methoxyl content in lower fractions of methanol-lignin shifted to the slightly higher fraction than in the previous paper and this is interesting as it perhaps means that loosely combined methoxyl group was stabilized in the elapse of time.

158. Fundamental research on the pulping of hardwood. (VII). Effects of the smaller fractions of beech pulp on the qualities of viscose. Nobuhiko MIGITA, Hayao HOSOI and Shikuro ISHIKAWA (Bull. Tokyo Univ. Forests **41**, 75-83, 1951)

The beech wood sulphite pulp was fractionated into five parts, i.e. 24, 24-48, 48-80, 80, 80-150 and 150-200 mesh fractions (F_1, F_2, F_3, F_4 and F_5), and on each fraction yield, anatomical and chemical compositions, degree of polymerization, reactivity for the stains, swellability and solubility were determined. The viscose solutions prepared from the fractions were also examined in their viscosity, clearness and filtrability. From the results of experiment the causes of poor filtrability of viscose prepared from hardwood pulp were discussed.

(1) F_1 and F_2 almost consisted of wood fibers which possessed the original shapes. Wood fibers found in F_3-F_5 were more or less broken down. Vessel members were found in F_3 and F_4. Ray cells and parenchyma were mainly found in F_5, but a few of them were found in F_4, also.

(2) There were little difference between the chemical compositions of the five fractions. The degree of polymerization, however, decreased considerably from F_1 to F_5.

(3) A few wood fibers in F_1 and F_2 were easily stained by the DELAFIELD hematoxylin method. These fibers were noticed to be hardly dissolved when the viscose solutions were prepared from the pulp fractions. The zinc chloride stain test showed that cellulose fibers of the fractions were more or less degenerated, but those even in F_4 were negative for the oxycellulose test.

(4) The swellability and the solubility decreased in order of F_1, F_2, F_3, F_4 and

F_5. The fragments of wood fibers and vessels members showed no balloon swelling, which is characteristic of the normal cellulose fibers. Ray cells and parenchyma were hard to be swollen.

(5) The undissolved matters found in the viscose solutions consisted of wood fibers which were easily stained DELAFIELD method, terminal ends and fragments of wood fibers, fragments of vessel members, some of ray cells and parenchyma.

(6) Among the viscose solutions V_2, V_3, V_4 and V_5 which had been prepared from F_2, F_3, F_4 and F_5 respectively, the following tendencies were observed.

Clearness: $V_2 > V_3 > V_4 > V_5$

Filtrability: $V_4 > V_3 > V_2 > V_5$

The undissolved matters and gel-formation of cellulose materials, whose degrees of polymerization were abnormally high, are considered to be the main factors of hindering the filtrability of viscose solutions.

(7) The filtrabilities of mixture of these viscose solutions were poorer than the individual viscose solutions, because the factors of hindering the filtrability of viscose were accumulated in the mixture of solutions. By this reason viscose solution of hardwood pulp, which is less uniform than softwood pulp, is of poorer solubility. Therefore if hardwood pulp is purified by screening, its quality as a rayon pulp may be considered considerably improved.

159. Studies on the pulp treated with formaldehyde. Nobuhiko MIGITA, Junzo NAKANO and Shigeru YAMAMOTO (Journ. Soc. Textile and Cellulose Indust. 7, 437-439, 1951)

KANTROWICZ (1942) reported that if pulp was treated with formaldehyde, the apparent content of α-cellulose increased without a marked hindrance to xanthogenation of pulps. Upon this assumption, his idea may be applied for the improvement of the qualities of hardwood rayon pulp. The authors formalized beech wood pulp (containing some softwood pulp) by means of formalin or paraformaldehyde, and determined the amounts of combined formaldehyde and the apparent contents of α-cellulose on the resulting products. Then, viscose was prepared from the formalized pulps in an ordinary method. Within the range of experiments the authors recognized that the formalized pulps, contrary to the view of KANTROWICZ, were not easily xanthogenated. The unevenness in stabilities of combined formaldehyde of the formalized pulps prepared by different methods, suggests that there are probably two types of combination of formaldehyde with pulp.

160. Chemical studies of cork substance (II). Chemical composition of suberin in the cork of Quercus variabilis. Nobuhiko MIGITA, Takashi KANDA and Rikio FUJINAMI (Journ. Jap. Forest. Soc. **33**, 424-426, 1951)

The chemical components of so-called suberin in the cork-bark of *Abemaki* were studied. After the ether-extracted cork flour was treated with 3% Na_2SO_3 solution, the residues were saponified repeatedly with an excess of 3% alcoholic caustic soda solution on the boiling water-bath. The whole alcoholic solution was then filtered off. The filtrate obtained was treated by the method proposed by ZETZSCHE, and the chemical components of suberin part were separated into eighteen fractions. Among the eighteen fractions, eight fractions were white powder or crystalline substances and the others were liquid or solid oil substances. From the test of the melting point and other chemical nature, the white powder or crystalline substances were

considered to be the following acids, namely, suberic, suberonic, phellonic, eicosandicarbonic.

161. Studies on the lignin (XII). The methoxyl groups in lignin. Nobuhiko MIGITA and Junzo NAKANO (Journ. Soc. Textile and Cellulose Indust. 8, 81-85, 1951)

In order to see whether the aliphatic methoxyl groups can exist in lignin, attempts were made to separate the aliphatic methoxyl group from the aromatic one. As the difference of reactivities of hydroiodic acid on the two types of methoxyl group was not significant enough, separation of the methoxyl groups could not be succeeded with in a range of experiments. The difference was not recognized between the reactivities of methoxyl groups in the hardwood lignin and in the softwood lignin. The hardwood, however, probably contains more unstable methoxyl groups as compared with the softwood.

162. On the mechanism of color reaction of lignin (I). The relation between the color reaction of chlorinated lignin and MÄULE reaction. Nobuhiko MIGITA and Junzo NAKANO (Bull. Tokyo Univ. Forests **43**, 139-144, 1952)

Some studies were carried out on the MÄULE reaction, which is characteristic for discrimination between hardwood and softwood. The results may be summarized as follows:

(1) The MÄULE reaction is not due to the chlorination of lignin, but the oxidation by $KMNO_4$.

(2) The mechanism of the MÄULE reaction has been considered to be identical with that of Cl_2–Na_2SO_3 reaction. The results of the author's experiment, however, show that there is a distinct difference between them, because the properties of color developed by the two reactions are not the same. This conclusion may be also supported from the result that the MÄULE reaction occurs even without reagents containing the factors of chlorination.

(3) After $KMnO_4$–HCl (or –H_2SO_4) treatment of beech and larch wood, MnO_2 and MnO(?) are recognized only in the former but not in the latter by means of the electron diffraction study. Within the range of experiment it is not clear whether or not these compounds take part in the MÄULE reaction.

(4) Several holocellulose samples varying in the content of lignin were prepared. The lower the content of lignin, the lighter the red color developed by the MÄULE reagents. Therefore it is concluded that the MÄULE reaction is surely based upon lignin itself.

163. On the mechanism of color reaction of lignin. (II). The mechanism of the MÄULE color reaction. Nobuhiko MIGITA, Junzo NAKANO and Tadashi NAGANO (Bull. Tokyo Univ. Forests **43**, 145-149, 1952)

Beech wood meals treated with various reagents were examined as to whether or not the MÄULE reaction is positive. After acetylation, methylation or phloroglucinol treatment wood meal still gave a distinct red color. As the existence of introduced groups had no influence on the color developed by the MÄULE reagents, the authors could not succeed in explaining the mechanism of the MÄULE color reaction. However, the results that acetylated or methylated samples are positive in the MÄULE reaction will serve as a useful suggestion in the development of future experiments.

VII. Zootechnical and Veterinary Science

Abstracts Nos. 164—184

164. A myographic study of the muscles concerning to standing-posture of goat. Shinichi NOMURA and Tamotsu OGATA (Science **22** (2), 92-93, 1952)

The table gives the principal muscles of goat that have to do with maintaining the normal standing-posture. We inquired which muscle contracts, through the myogram induced by coxial needle electrode. The mark (+) shows that the muscle works and (−) that it doesn't work.

1.	M. splenius cap.	++	24.	M. ext. carpi rad.	+++
2.	M. splenius cerv.	+	25.	M. ext. dig. comm.	+++
3.	M. serratus dors. cran.	++	26.	M. ext. carpi uln.	+++
4.	M. serratus dors. caud.	++	27.	M. flex. carpi rad.	+++
5.	M. longissimus cerv.	−	28.	M. flex. carpi uln.	+++
6.	M. longissimus dors.	−	29.	M. flex. dig. prof.	+++
7.	M. trapezius cerv.	+	30.	M. iliopsoas	+++
8.	M. trapezius thor.	+++	31.	M. glutaeus super.	++
9.	M. rhomboideus cerv.	++	32.	M. glutaeus med.	+++
10.	M. serratus vent.	++	33.	M. glutaeus prof.	+++
11.	M. brachiocephalicus	+++	34.	M. tensor fasciae lat.	−
12.	M. pectralis super.	+	35.	M. biceps femoris	−
13.	M. pectoralis prof.	−	36.	M. semitendinosus	−
14.	M. deltoideus	+++	37.	M. semimembranosus	−
15.	M. supraspinatus	+	38.	Mm. adductores	−
16.	M. infraspinatus	−	39.	M. vastus lat.	+
17.	M. subscapularis	+++	40.	M. vastus med.	+++
18.	M. biceps brachii	+	41.	M. rectus femoris	+
19.	M. brachialis	−	42.	M. tibialis ant.	−
	M. triceps brachii		43.	M. ext. dig. ped. long.	−
20.	caput long.	−	44.	M. gastrocnemius	+++
21.	caput lat.	−	45.	M. flex. dig. ped. sup.	++
22.	caput med.	+++		M. flex. dig. ped. prof.	
23.	M. tensor fasciae ant.	−			

The table will make it clear that many muscles help skeleton to support the body against gravity and fix the moval-joints at their resting state.

The number of neuromuscular units of goat is notably less than in man, whereas the spike discharge intervals flactuate about 0.1-0.3 sec.

165. On the respiration of horses, especially alteration of its frequency during their field-labours. Hiroshi SAWAZAKI, Yoshio SETO, Takayoshi MIURA and Yoshio SHIMODA (Jap. Journ. Zootech. Sci. **23** (1), 13-18, 1952)

We had an experiment on the respiration of horses during their field-labour with three farm horses, in the stock farm of Tokyo University. Respiration-frequencies and draft-resistances during their labours; the ploughing, the cultivating and the

harrowing, moreover the free-walking as a control; and recoveries of respiration, pulse and body-temperature were observed. The labours were 120 m, 23 turns and 65 m, 14 turns.

The results were as follows:

(1) Respiration-frequencies during field-labours moved back to the steady states with the waving curve. They increased in harrowing most remarkably, in ploughing the next, and in cultivating the smallest.

(2) On the respiration-frequencies in walking and in turning, the former was higher than the latter in ploughing and in cultivating; besides in harrowing and in free-walking, both the values were approximate. So we supposed that the turning in ploughing and in cultivating was a temporary rest for animals, but in continued resistance as harrowing was not.

(3) Recoveries were not equal, but the after-values were similar to the relations between the respiration and the labours as mentioned above in all items.

(4) The average draft-resistances in ploughing and in harrowing were 30-35 Kg, and in cultivating 20-25 Kg; the degree of respiration-frequencies was in proportion to the intensity of labour during the exercises.

166. Studies on the serum-cholinesterase of horses. 1. About the normal or physiological activities. Toshio OKABE, Takayoshi MIURA and Yoshio SHIMODA (Jap. Journ. Vet. Sci. **13**, 4, 1951)

Measuring the activities of serum-cholinesterase of more than 700 Japanese horses by the modified method of HALL and LUCAS, we obtained the followings.

(1) The normal serum-cholinesterase activities of Japanese horses are 1.635-2.763 in the ranges of distribution and their means are between 2.175 and 2.223 in the fiducial ranges.

(2) Their differences of race and sex are not significant. But the activities of Kiso-ponies (Mean value: 2.003-2.165) are lower than those of any other race.

(3) The activities seem to become higher with age, but it is only significant statistically that the mean value of the yearlings (1.903-2.127) is lower than that of the other ages.

(4) The activities differ obviously according to the seasons of the year. In Winter and Spring they are higher than in Summer and Autumn. Also in this case the Kiso-ponies are different from other races, for there are no differences between their activities in Winter and in Summer.

(5) The activities may be different at times of the day, but this is also not significant statistically.

In conclusion, we find that the activities of the serum-cholinesterase of horses differ according to the individual and maintain their levels while the animals are kept in the physiological condition, except when influenced by the seasons of the year.

167. Studies on the serum-chlinesterase of horses. II. Changes in the activities induced by exercises and trainings. Takayoshi MIURA and Toshio OKABE (Jap. Journ. Vet. Sci. **14**, 1, 1952)

We determined the changes of serum-cholinesterase activities of horses, due to various kinds of exercises. And we observed the alterations of activities in race horses during the course of their training, comparing them with the normal or physiological activities as cited in our previous report.

The results obtaiend are as follows:

(1) After 2 hours straight riding, the activities of serum-cholinesterase decreased to 81.8-92.9% in the average of 32 cases. However the degree of this decrease is governed, in general, by the pre-exercise condition of the individual animal.

(2) 22 horses were exercised, similarly, twice a day for 25 days. Then after a rest of 10 days the same exercises were resumed for another 25 days. After the first 25 days, the activities of serum-cholinesterase decreased to 80.7-84.1% in almost all horses, even during the rest period. After the second 25 days these activities further decreased to 71.7-78.4% in the average, but the variations were observed again to have been resumed in the case of (1).

(3) We instituted a light retraining period of about 2 months for 3 retired race horses and measured the activities of serum-cholinesterase once a week before and after a 1300 m race. We noted that the activities of the resting period were maintained or increased during this time. However, the influence of the exercise (1300 m race) became smaller by degrees.

(4) We then observed the phases of alteration in the activities of serum-cholinesterase in 20 Angloarab yearlings undergoing training for the track. We measured the activities during their resting periods, every 3 or 5 weeks over a period of 10 months and classified the alteration curves for the whole course of the observation into 4 types. The types which we considered as the combinations with the results cited in (1), (2) and (3) have an interesting relation to the marks set by each horse in the races of the following season. Type III was the best. Type I was the worst. Type IV was hopeful. Type II was uncertain.

Conclusion: The serum-cholinesterase activities of horses in resting periods are decreased by continued heavy exercises, but are maintained or increased by continued light exercises. In the latter case the influence of exercise on the activity of serum-cholinesterase lessons day by day. The alteration curves of serum-cholinesterase activities in race horses, during the courses of their trainings, are considered as the combinations of the above results and divided into 4 types. We think these are interesting points in relation to the fatigue and the training of horses. However we can not give any exact decision as to the limits of "heavy" or "light" exercise.

168. Studies on the development of the sexual maturation in the male. I. New kinds of ejaculatory responses in the rat and their application as the indicator of sexual activity. Yoshisuke SUZUKI (Jap. Journ. Vet. Sci. **14**, 115-128, 1952)

In the rat, several kinds of ejaculatory responses were found. They were named the ether ejaculation, the spontaneous ejaculation, the blow-on-head ejaculation and the alcohol ejaculation.

Using the first three responses as the indicator, analyses of developmental pattern of the ejaculatory function and the reproductive activity with the progress of age were performed.

Summary of the results is already reported in Med. and Biol. 17, 156, 1950., ibid. 19, 221, 1951., ibid. 19, 162, 1951., and in this record. No. 1 (1950-1951) pp. 86-90 (English).

169. On the seminal ejaculation. III. The correlation between the rate of ejaculatory responses and the fertilizing capacity in the male rat. Yoshisuke

SUZUKI, Noboru YOTSUYANAGI and Yasuo TOSHIMORI (Med. and Biol. **22**, 91-93, 1952)

To confirm the validity of the new ejaculatory responses, described in the previous papers as an indicator to evaluate the activity of reproductive function, the relation between the frequency of the positive responses and the fertilizing capacity of individual adult male rats was investigated.

By 6-10 times trials of the ether ejaculation test repeated during the age of 150-200 days, the frequency of the positive response, including the spontaneous ejaculation response which happened to accompany the test on a few occasions, was determined. Eight rats, having various frequencies of the response were selected and used in the fertilizing tests after the 200th day of age. The respective male was placed in the box containing 5 females, for two hours daily. For the rest of the time, it was separated from the females. And the fertilizing capacity was determined by the relation of the number of pregnants to the number of copulated females.

There was found an intimate correlation between the both, that is,—the rats having 100, 100, 60, 38, 20, 13, 13, and 0% of the frequencies of the positive response respectively showed 83, 80, 56, 33, 42, 22, 0 and 17% of the fertilizing capacity. Further, it was found that the rat with the lower rate of response copulated less frequently than the higher one.

From the results, it became clear that the male of higher rate of the response surpassed that of lower rate not only in the activity of ejaculatory function but also in the reproductive activity.

170. On the seminal ejaculation. IV. Application of the "Ether Ejaculation" response on analyses of the life span of the epididymal sperm, and of the maintenance of the ejaculatory capacity in the rat. Yasuo TOSHIMORI and Yoshisuke SUZUKI (Med. and Biol. **23**, 188-191, 1952)

Applying the electric ejaculation test and the motility test of isolated epididymal sperm on guinea pigs in various conditions, such as, normal, castrate, and cryptorchid, MOORE et al. (1928) have demonstrated that androgen intimately controls the life span of epididymal sperm and the maintenance of the capacity producing the coagulable ejaculate.

In the present paper the ether ejaculation test, described in previous paper (Jap. Journ. Vet. Sci. **14**, 115, 1952) was applied to trace their experiments.

In the castrated rats, motile sperm could not be recovered beyond the 12th day after the operation, and even the formation of coagulable ejaculate did not exceed the 24th day. On the other hand, in the normal controls which had isolated epididymis, motile sperm was obtained upon the 25th day, and the ejaculatory capacity was well preserved during the whole experimental period. And the ejaculatory capacity was maintained in the experimental cryptorchid animals as well as the normal controls, whereas the recovery of motile sperm did not exceed the 6th day after the operation.

Since these results were in good accord with the discoveries by MOORE's experiments carried out on guinea pigs, we are convinced that the ether ejaculation test is an useful assay for studying the physiology of reproduction. Moreover, procedures of this test are quite simple, and the observation can be accomplished continously without sacrificing the animal.

171. Prediction of the dairy performance in goats by the induced lactation

with the injection of synthetic estrogen. 1. On the induced lactation and mammary development. Motoo NAITO and Akira YOKOYAMA (Jap. Journ. Breed. 1, (4), 223-232, 1952)

The examination of possibility that the dairy performance may be predicted by means of the induced lactation by the injection with synthetic estrogen in virgin goats is being carried out. The results on the induced lactation and mammary development in this report are briefly summarized as follows.

(1) Sixteen virgin goatling were injected subcutaneously with 0.25 mg. Diethylstilbestrol in oil daily for 20 days and the induced lactation was examined.

(2) The lactation curves showed various individual differences, but they might be classified generally into 3 types; the first, daily yield increased rapidly and was followed by slower increase to the maximum; the second, it increased moderately with the constant rate to the maximum; and the third, it increased very slowly and the maximum was not so high as in the former two. Further, such results as the coefficient of regression line at rapid increase, maximum yield, maximum period, duration, total yield and average daily yield may be notable.

(3) The mammary development was studied histologically on 5 of the goats in such various periods as yearling breeding season—at dioestrum, out breeding season in the next year—5 days before the initial of treatment, the 11th day and 40th day after the initial of treatment. The results showed that such induced milk was secreted from the normal-like functional site of the gland—alveoli.

(4) Being no relation found in the former control periods, fair relation seemed to be present between the following maximal milk yield and the area of each alveolus even on the 11th day and also on the 40th day after the initial of the treatment.

(5) The probable difference between such an induced lactation and normal one may be that the milk yield in the former starts from 0 and may be less on both the maximum and total yield than those in the latter. Such differences seem to be caused by the differences in both absolute and relative levels of stimulators and their acting periods.

(6) The method, dose and duration of administration, and examination season were discussed and the conditions mentioned above in (1) seemed to be the most suitable.

To conclude whether such trial is available for the prediction of dairy performance or not, these results must be compared with those of the normal lactation after parturition in the next year.

172. **Interpretation of changes of the small intestine caused by drugs.** Yoshio ÔKUBO, Iwao YANAGIYA (Med. Sci. 3, 158-162, 1952)

It seems generally held that the cholinergic drugs increase motility of the intestine and the adrenergic drugs decrease it. The conclusion must be also warranted on the intestinal movements observed by an abdominal window method which showed them in three typical modi. This study was attempted to know the effects the cholinegic or adrenergic drugs on the intestinal modi and to establish the correlation between motility and modi of the intestine.

Experiment A Rabbits were conditioned to show a state of the intestinal motility where more than half of movements were the segmentation and the others the peristalsis. Intravenous injection of adrenaline (0.1 mg./kg.) caused an instantly

arrest of the intestinal movements. In the succeeding recovery process pendular movements appeared first. Next, rhythmic segmentations and then peristalses occurred successively. The pendular movements disappeared when the rhythmic segmentations began to appear. Then, segmentations and peristalses gradually increased their frequency and strength until the normal state of the movements. In the recovery process the movements appeared in such an order as pendular movements, rhythmic, segmentation and peristalsis.

It seems possible that the motility extremely decreases in the stage of the intestinal arrest caused by adrenaline and gradually recovers throguh the recovery stage. If such an idea be real, the disappearance of movements provoked by adrenaline shall follow a process of reverse order against that of the recovery stage. Successful experiments were conducted by injecting very slowly a high diluted adrenaline solution. The results obtained herein provided an experimental basis for such a suggestion as mentioned above.

Experiment B Using cholinergic drugs, namely, acetylcholine, prostigmine and carbaminoylcholine, experiments like exp. A. were conducted to know the changes of the intestinal modi when the motility should increase beyond ordinary state.

In an intestine in which peristalses and rhythmic segmentation appeared about half and half, pilocarpine (0.05-0.1 mg./kg.) increased a frequency of the peristalsis and decreased that of the rhythmic segmentation. Large doses of pilocarpine (0.5-1.0 mg./kg.) displaced all movements to peristalses, and lastly caused a complete arrest of the movement and a marked increase of the intestinal tone for a short time. Thereafter pendular movements appeared first and some time later rhythmic segmentations succeeded. Thus, the intestinal movements returned to the normal modi.

Such data, as are presented in exp. A and B, indicate that the modi of the intestinal movement transform themselves, according to the increase of motility, as follows:

no movement (the lowest motility)→Pendular movements→rhythmic segmentation→peristalsis→pendular movement (tone increasing)→ arrest of the movement (the highest motility)

Provided with the motility changes toward the descending direction, the movements shall transform the modi in a reverse order against that mentioned above.

173. Effects of the viscosity of the intestinal content and osmotic pressure on movements of the small intestine. Yoshio ÔKUBO and Iwao YANAGIYA (Folia pharmacol. japon **47**, 64-65, 1951)

1. Effects of the viscosity of the intestinal content.

In studies on the intestinal movements of the rabbit through an abdominal window, it was observed that there appeared not only the three normal types of movements, but frequently several transformers. Most of them were intermediate types between peristalsis and rhythmic segmentation.

Experiments were performed on the intestine of the rabbit by the abdominal window method and on the excited intestine of the guinea pig by the modified method of BAUR's.

The observations show that in lower degrees of specific viscosity (below 20-22)

there appeared a transformative modus of the rhythmic segmentation, in which the intermediate portion between segmentations contracted, though the contraction was less strong than that of the segmentation. The quantity of the intestinal content given artificially did not affect the occurrence of the transformative movements.

2. Effects of osmotic pressure of the solutions applied on the intestinal wall.

Solutions of different osmotic pressure were applied on the surface of the intestinal wall in the rabbit with an abdominal window. 0.5% NaCl and 0.20% glucose solutions were poured on a portion of the intestine under observation by a needle inserted through the abdominal wall.

(a) Hypotonic solutions (water, 0.25% NaCl solution and 1.2% glucose solution) make an inhibitory influence on intestinal motility. The movements disappeared during a few minutes just after the application of hypotonic solutions, then occurred again according to the following order; pendular movement rhythmic segmentation peristalsis. In the recovery period, there appeared a transient slight increase of tone and a slight hyperaemia.

(b) Isotonic solutions did not cause any change of motility, tone and local circulation.

(c) Hypertonic solutions (1.5, 3.0 and 5.0% NaCl sol., 10 and 20% glucose sol.) caused a marked increase of circular tone just after the application, and then the movements disappeared for a few minutes. The recovery occurrence of the movements was done in the same order as that of hypotonic solutions. A transifory hypertension used to appear in the recovery stage, but sometimes it was antecedent to the abolition of the movements. The changes of both tone and circulation disappeared at the same time as those of motility.

From the results obtained and our previous studies, it is concluded that the non-isotonic solutions, either hypotonic or hypertonic ones, produce a simple inhibition only.

174. Crisism on the TRENDELENOURG'S theory on the peristalsis. Iwao YANAGIYA (Folia pharmacol. japon 47, 64-65, 1951)

According to the previous studies on intestinal movements (ÔKUBO and YANAGIYA 1950) it was concluded that three typical modi involving peristalsis were observed and larger masses of intestinal contents increased the peristalsis frequency. The other studies clarified the role of the intestinal bending which accelerated origination of the peristalsis or strengthened it, being a resistance to the chyme transportation.

However, the above discoveries do not provide the appropriate explanation of the occurrence of peristalsis in the leer intestine.

Experiment A The excised preparation of the guinea pig's intestine was used by the method of TRENDELENBURG but in visual observation. By raising the pressure bottle the inner pressure on the intestinal wall increased from a starting negative pressure to a certain positive one.

Week peristalses originated already at a negative pressure, but a strong peristalsis suddenly occurred beyond a certain positive pressure. The former ones appeared whenever a weight attached in longitudinal direction was omitted, but the weighting diminished the probability of their appearance.

Experiment B In the excised intestine, laid in a dish containing TYRODE's solu-

tion without any weight, weak peristalses appeared in negative pressure of the intraintestinal fluid, that is to say, in leer intestine. When the intestine is attached with a weight, it makes the appearance of peristalsis difficult. The heavier, the more difficult.

When the inner pressure of the intraintestinal fluid balances with that of the outer one, some amount of contents entered into the intestinal lumen without any positive pressure on the wall. In this case the intestine was free from pressure, but it contained some content in the lumen. Weak peristalses appeared like in a leer intestine. The weighting also prevents the appearance of it, but the weight for prevention was heavier than that in a leer intestine. The results suggest that the weighting makes the occurrence of the weak peristalsis difficult, but the intestinal content facilitates it.

Experiment C Supporters of TRENDELENBURG's theory speculate that peristalsis originate beyond a certain inner pressure by its stimulation. There is a possibility, however, that extension of the intestinal wall through the pressure of the inner fluid might facilitate the origination of peristalsis. An attempt was performed to ascertain it.

A piece of excised intestine was laid in a glass cylinder filled with TYRODE's solution. The outer fluid of the intestine might be sucked through a branch of the cylinder.

Granting that the fluid was permitted to enter into the lumen from the reserved bottle when the outer fluid was sucked, strong peristalses originated successively. Unless the fluid was permitted to enter, peristalsis did not appear even if the outer fluid was sucked. It appears that the extention of the intestinal wall is needed for the origination of peristalsis.

175. Factors causing the antiperistalsis in the small intestine. Iwao YANAGIYA (Folia pharmacol. japon **48**, 131-132, 1952)

In the normal movements of the small intestine the antiperistalses are rarely to be observed. The previous studies by us (ÔKUBO and YANAGIYA, 1951) suggest the importance of the intestinal bending for the occurrence of antiperistalsis.

Experiment A A glass canula was attached to a long piece of excised intestine (about 40 cm) at its oral end. The intestine was laid in TYRODE's solution, being bended at a certain point near the aboral end. On the other hand, a balloon was introduced into the intestinal lumen through the canula.

Peristalses originated by expanding the balloon and pushed the content to the bending portion of the intestine. Then the content was held at the oral side of the bending portion, which made a resistance itself against the passage of the content. In nine cases in which the bending was strong enough to prevent the passage of the content, antiperistalses originated in four cases at a portion about one cm. apart from the bending.

Experiment B In the present experiments some gas bubbles were plaecd at the oral side of the bending point, the other operation being the same as exp. A. Antiperistalses originated in more cases than that of exp. A. (7 in 10 cases).

Experiment C When a glass rod was introduced and fixed in place of bending, the same results were obtained in 16 of 20 cases. But the antiperistalsis did not appear when the inner fluid of the intestine had been removed.

It is really evident that the antiperistalsis appears when there are some powerfully bending regions in the intestine and the bending prevents the passage of the intestinal content. In the leer intestine the antiperistalsis does not occur. Too weak peristalses provoke only short travelling antiperistalses or do not at all.

176. Sweating in the horse caused by administration of procaine. I. Administration by perineural blocking. Masaaki HATAYA (Jap. Journn. Vet. Sci. **14**, 65-74, 1952)

Procaine hydrochloride is an excellent anesthetic agent for topical use. It has a potential effect in producing local insensibility, stability to the pasteuralization and toxicity of minimal grade. It has been employed in surgical operaions at clinics for both humans and domestic animals throughout the world since its discovery by EINHORN, in 1905. However, the following fact has been noticed clinically by the writer at surgical operations on the horse. Sweating occurred in the operation areas of the skin when procaine solution was administered subcutaneously to produce local anesthesia in the horse. Also, a similar effect was noted when an experiment investigating cutaneous innervation of the radial nerve was carried out on a horse by the writer in 1943. In the experiment, sweating was brought about in the area of skin which was innervated by cutaneous rami of the radial nerve, by the administration of 20 cc of one per cent procaine solution around the stem of the nerve on the lateral aspect of the humerus for the purpose of anesthesia by blocking. Thereby the extent of sweating area was identified substantially with th anesthetized area of the skin.

Although adrenalin chloride, a sudoriferum to the horse, has been commonly added in trifling quantities to procaine solution for contracting the small blood vessels, a single administration of procaine solution without adrenalin also brought sweating in the horse.

The experiments dealt with in the present paper were performed on three horses, for confirming the incidents in relation to the radial nerve, mentioned above.

The horse was placed in the standing position, and the lateral aspect of the brachium and the antibrachium was cleaned and shaved. After the surface of the skin was dried, it was painted with a mixed solution of tincture of iodine and castor oil, and then dusted over with soluble starch (MINOR's method). A long needle was inserted through the skin at the site of the groove between the triceps brachii, the brachialis and the extensor carpi radialis muscles, in the caudo-medial direction, with considerable obliquity. When the needle established contact with the lateral surface of the humerus, it was slightly pulled back and the procaine solution injected. In a few minutes the activity of the extensor muscles of the antibrachium was interrupted and local anesthesia followed over the area of the skin innervated by cutaneous rami of the radial nerve and a little later the sweat secretion was visualized as small black spots in the corresponding area of the skin. As the sweating became more evident, the sweat spots increased in size. This sweating response reached its maximum in 20 to 30 minutes and then declined until it ceased, 40 to 60 minutes after injection.

The results obtained with three horses were compared and the extents of both anesthetized and sweating areas were recognized substantially as the same.

In the area of the skin innervated through the radial nerve, and in which sweat-

ing once occurred after blocking with procaine solution, the sensitized condition of the sweat glands was not terminated at the cessation of the blocking experiment and the effect was a prolonged one. A few days after the experiment, sweating was repeatedly observed in the same area of the skin when the horse was excited mentally, or when resisting the manipulation of restraint. This sensitized condition remained in the horse for 34 days.

Muscular exercise of the horse with a sensitized condition of the sweat glands caused no particular sweating in the same area compared with remaining surface of the skin.

Furthermore, an examination was made with the musculocutaneous nerve of a horse by the same method and similar results were obtained on the inner aspect of the antibrachium.

177. Sweating in the horse caused by administration of procaine. II. Administration by subcutaneous infiltration. Masaaki HATAYA (Jap. Journ. Vet. Sci. **14**, 75-82, 1952)

In the previous paper it was described how sweat secretion took place in the area of the skin of the horse which had been innervated by cutaneous rami of the radial nerve, when 20 cc of 1% procaine solution was injected around the stem of the nerve on the lateral surface of the humerus for the purpose of anesthesia, by blocking.

Furthermore, the following experiment was carried out to investigate the response of the sweat-glands of the horse to the administration of local anesthetics by means of subcutaneous infiltration.

Procaine (1%, 2%, 3%), Novocaine-Epinephrine (Cook Lab.) and Novocaine-Cobefrine (Cook Lab.) were employed as local anesthetics and Adrenalin chloride ($1:10^5$) was used as control.

As the sites for the administration of the preparations, the neck, shoulder, breast and flank were chosen, and the skin was cleaned and shaved. The method for examinating the sweat secretion was described in the previous paper.

The sweat glands of the horse responded as well, to the administration of local anesthetic drugs by infiltration, when the needle was correctly positioned in the subcutaneous tissue as in the case of administration for blocking. Sweating began to appear over and around the injection wheal within 5-10 minutes after injection and spread, under some circumstances, progressively, by forming processes or branches of sweat spots, along with the expansion of the anesthetized area. The sweating area spread widely with the distal direction of the nerve, when the nerve fibres in the subcutaneous tissue just passed through the injection wheal. In all cases the extent of the sweating area corresponded approximately with that of the anesthetized area.

On employing novocaine solution mixed with a small dose of epinephrine or synthetic adrenalin-like compounds, the secretion of sweat became more evident when compared with the single administration of procaine solution. By subcutaneous administration of adrenalin solution ($1:10^5$) as control, sweating developed noticeably over the injection wheal without causing any anesthetic effect.

Among the causes of the sweat secretion in the horse resulting from the local administration of procaine solution mentioned above, the following should be in-

cluded: (1) procaine may possess an adrenalin-like action such as is well known in the case of cocaine, (2) there are nerve fibres innervated to the sweat glands the function of which is influenced by procaine.

178. Studies on the activity of the new anticoccidial drugs, Nitrophenide and Bisphenol, on experimental cecal coccidiosis (*E. tenella*) in young chickens. Yoshio ÔKUBO, Miyoshi IKEDA and Norimoto URAKAWA (Jap. Journ. Vet. Sci. **13**, 160-261, 1951)

Nitrophenide (by Dainihon Seiyaku Co.) is chemically m,m′-dinitrodiphenyl disulfide and Bisphenol (Parabis 90, Amer. Dow Chem. Co.) 2,2′-methylene bis 4-chlorophenol. White Leghorn male chickens, 2-4 weeks of age, were used. Approximately 80,000-100,000 oocysts of *E. tenella* were inoculated into the crop of each bird with a syringe. The treatment with the drugs started on different days before or after the inoculation. The drugs were administered to the chickens in a form mixed in all-mash feed 4 times a day. On the 8th-9th day after the inoculation, all survivors were killed and autopsied. The chief criteria showing effectiveness throughout these experiments were the mortality, weight gains, a number of bloody droppings, lessions of ceca and toxic signs of the drugs.

The results obtained were as follows:

(1) The anticoccidial effects of the drugs on cecal coccidiosis.

(a) Nitrophenide. Various mash containing 0.01, 0.02, 0.03, 0.04, 0.05, 0.1 percent of the drug were given on different day after or before the inoculation. The higher levels than 0.04-0.05% were sufficient to prevent loss of coccidiosis and appreciable clinical symptoms if given not later than 2-3 days after the inoculation. Apparently, even the lower levels (0.02-0.03%) reduced significantly mortality due to coccidiosis.

(b) Bisphenol. When Parabis 90 was administered at the different level, 0.1, 0.2, 0.4, 0.5, 1.0 per cent in all-mash feed, starting 2 days before the inoculation, the feed containing 0.4-0.5 per cent of the drug were most effective. There was no evidence of blood in the droppings. Survivors had neither lessions nor cocysts in ceca. At lower levels, 0.1, 0.2 per cent, no successful results were obtained. The treated birds showed an evidence of extensive hemorrhage, gross lessions and a large number of cocysts in ceca and suffered from heavy mortality.

(2) The effects of the drugs on the treatment started at various times after the inoculation.

(a) Nitrophenide was effective if given not later than 2-3 days after inoculation, but if later than 4 days, no protective action is disernible.

(b) Bisphenol was effective if given 1-2 days before the inoculation, but at the time of oocyst inoculation or later its prophylactic effects decreased markedly.

(3) An attempt was perfomed to ascertain the effects of the treatment on the sporulation of oocysts produced by infected chickens which were treated with the effective dose of the drugs for 3 days from 7th day after the inoculation. The following results were obtained: the percentages of sporulation of oocysts were 68% in Bisphenol, 14% in Nitrophenide, and 79% in untreated control.

(4) The acute and chronic toxicity of the drugs in chickens.

(a) Nitrophenide. A long-term continuous administration during a period of 30 days at the lower level of the drug than 0.05% did not cause any growth retarda-

tion, being readily accepted by the chickens. In acute toxicity in the chickens at the lower dose than 750 mg. drug/kg. body weight with a single oral dose, no death occurred for 5 days after an administration of the drug, but the higher dose produced marked toxic symptoms in the chickens, namely; disturbance of posture and locomotion, retardation of growth, and death.

(b) Bisphenol. A long continuous administration for 30 days showed a very slight depression of final weight gains at the drug level of 0.5%, being, however, readily accepted. But at the higher level than the effective dose, the treated chickens suffered from a decrease of the uptake of the feed, probably owing to the offensive odour of the drug, but the other appreciable signs of toxicity of the drug were not observed.

179. Field observations on the efficacy of Nitrophenide, Bisphenol and Furacin for the practical control of coccidiosis in young chickens. Miyoshi IKEDA, Norimoto URAKAWA and Kogi ISHIZAKI (Jap. Journ. Vet. Sci. **13**, 346, 1951)

Our previous experiments indicated that Nitrophenide, Bisphenol and Furacin had some promise in the chemotherapy of chicken coccidiosis for a practical purpose. Further studies to elucidate these drugs for the prevention of coccidiosis due to natural infection seemed to be warranted.

(1) Experiments in A farm.

From May to September 1951, controlled field trials were conducted on the prophylactic treatment for coccidiosis with the continuous medication of the above drugs.

Medication was continued for 30-60 days. The drugs used and their concentrations in all mash feed were as follows: Nitrophenide 0.0125%, Bisphenol 0.2, 0.3%, Furacin 0.011, 0.0125%. Throughout the field trials, no sign of outbreak of chicken coccidiosis was observed in any group, even untreated controls, sothat, we could not clucidate prophylatic effects of the drugs on natural infection of chicken coccidiosis, but the appreciable effects of the drugs on the growth, weight gains, feed efficiency of chickens were not observed.

(2) Experiments in B farm.

Four field trials were conducted on Nitrophenide. Medication was started at the time when appreciable clinical symptoms of coccidiosis were already observed in some chickens and an outbreak was considered imminent in the other, and was continued from 2 weeks of age to 8 weeks. The loss of coccidiosis reduced markedly by the administration of the drug.

The mortalities of the chickens which were treated and untreated, were respectively 1.7%, 5.0% at 0.0125 per cent of the drug level; 0%, 16.0% at 0.2 per cent; 0%, 25.0% at 0.025 per cent; 3.2%, 40.0% at 0.03 per cent. It is difficult to determine the most effective concentrations of the drug on account of the different conditions of the contamination.

180. Ravonal* intravenous anesthesia in small animals. Masaaki HATAYA, Kazuya USUI and Tetsuo FUJITA (Journ. Jap. Vet. Med. Asso. **5**, 210-215, 1952)

Ranoval*: Thiopental Sodium, TANABE Pharm. Co., Osaka.

Thiopental sodium is well known by the name of Pentothal sodium and widely used as an ultra-short acting anesthetic at the clinics of both humans and domestic animals.

The 2.5 per cent aqueous solution of Ravonal was administered intravenously as a general anesthetic drug in various surgical procedures in the dogs and cats, and its prevalent anesthetic effects were recognized.

Operations performed on the dogs were: extraction of teeth (2), cutting short of teeth (1), enucleation of the eye (1), ear trimming (4), dissection of vocal cords (2), puncture of Ammon horn (2), tail docking (1), ovariectomy (14), orchidectomy (1), episiotomy (1), cesarean section (1), pan-ovariohystero-vaginectomy (1), treatment of painful wounds (2), resection of tumors (3), resection of verruca (1), biopsy (1), fluoroscopy (1), exchange of gypsum bandage (1), total forty cases. In three cats, an anesthesia was performed experimentally, while in other four cats, ovariectomy (3) and extraction of teeth (1) were carried out.

It has been widely advocated that the dosage of thiopental sodium can not be accurately judged by body weight, age, sex, metabolic state etc., and, furthermore, that it is dangerous when administered according to ordinary standards solely and in so-called average doses; and that it must be adjusted to each individual patient because susceptibility of patients for the drug is widely divergent. However, the results of our experience indicate that approximately 25 mg of Ravonal per kilogram of body weight may be a most profitable dose in the dog for a minor surgery of duration of from 10 to 20 minutes.

It is essential for expecting less danger of overdosage, that the rate of intravenous injection of 2.5 per cent solution should be slower than 10 seconds per each 1 c.c.

Ravonal is definitely more potent and less toxic than is evipal soluble. However, it is to be used only in cases of good anesthetic risks by expert anesthetists.

Ravonal is not recommended in major operative procedures requiring prolonged anesthesia, as in pan-ovariohystero-vaginectomy operation.

In 20 of 40 cases, an intermittent administration by fractional dosages was performed and a longer duration of anesthesia was obtained. However, a post-operative sleep was largely extended and tremor, struggling and other unfavorable side-effects developed in almost all cases.

On the cat, Ravonal brought about similar anesthetic effects to those in the dog with the approximately same dosage, although laryngeal spasm and other respiratory disturbances were likely to occur.

181. Studies on haemorrhagic septicaemia and its prevention. Yuichi OCHI (Bull. Off. Internat. Epiz. **37**, 351-358, 1952)

The bacilli of haemorrhagic septicaemia undergo variation easily on the artificial culture and change their characters remarkably. So it is insignificant to classify the group of these bacilli unless a deep consideration is given to their variability. Taking the variability of these bacilli into consideration, we performed bacteriological and immunological studies on the various strains isolated from cattle, swine, sheep, rabbits and fowls, and classified this group into four types, which we called type A, B, C and D.

Type A is isolated from haemorrhagic septicaemia in fowls and identical with so-called fowl cholera. The bacilli of the type B are isolated from acute septicaemia in cattle, swine, sheep and rabbits. Those of the types C and D are isolated from various animals and are etiological agents of infectious pneumonia and not of acute septicaemia.

Accordingly, haemorrhagic septicaemia in animals must not be considered merely as only one kind, nor such separate diseases as swine plague, haemorrhagic septicaemia of cattle and wild animals and that of buffalo according to the kind of animals. In compliance with the type of etiological agents, it must be called avian haemorrhagic septicaemia or fowl cholera when caused by the type A, and mammalian haemorrhagic septicaemia when caused by the type B. Although the bacilli of the types C and D belong to the group of haemorrhagic septicaemia, they are the etiological agents of infectious pneumonia and not of acute septicaemia. So strict differentiation must be done to treat these types.

Haemorrhagic septicaemia in fowls and Mammalia caused by the types A and B can be immunized highly by means of vaccines of killed bacillus and immune sera prepared from these strains. These biological products are very efficacious for field application. However, vaccines and sera prepared from the bacilli of the types C and D are not so efficacious against infectious pneumonia caused by these types of bacillus.

Infectious pneumonia caused by the types C and D does not manifest its symptoms only with the action of these types of bacillus, but the lesion on the mucous membrane of the respiratory tract which occurs as a result of influenza, long-distance transportation and climatic change becomes an important factor of pathogenicity. It will be difficult to prevent this disease unless thorough investigation is made into these points.

182. Studies on *Klebsiella pneumoniae*, with a special consideration on variability. Yuichi OCHI and Manabu OGATA (Jap. Journ. Vet. Sci. **14**, 152-158, 1952)

Our studies were conducted to clarify the conditions under which the variation of *K. pnumoniae* occurred. Then the variants were compared with the original type from biological, biochemical, and pathological points of view.

The organisms used in this investigation were seventeen strains of *K. pnumoniae* as determined by their cultural, biochemical, and pathological characteristics.

These strains were isolated from the following animals:

12 from pigs, 1 from the liver abscess of a mouse, 2 from rabbits (one from the nose and the other from the ear abscess of rabbits), and 1 from the lung of a horse. One strain used had an indefinite and obscure history.

The following results were obtained:

1. Three phases, that is, M, S, and R, were always observed regularly in the variation of *K. pneumoniae*.
2. When the M type of *K. pneumoniae* was cultured in bouillon not including NaCl, or when it was exposed to x-ray, the variation from M to S seemed to be accelerated.
3. There was no remarkable difference between the M type and the S with regard to their attitude in biochemical reaction.
4. The M type was highly virulent, and the S type non-pathogenic.
5. Seriologically observed, the S type was higher than the M type in agglutinability. Due to the agglutination reaction using the M type, consisting of those isolated from pigs and a mouse, and the other of those from a horse. However,

when the S type was used in the agglutination reaction, no classification could be made.

The same results were obtained when these two types were used in the precipitation tests.

But in complement fixation tests the 16 strains were not classified by using the M type as well as the S type.

6. Immunization with the M type, living or heat-killed, protects white mice against M type infection. While, immunization with the S type could not protect them against M type infection.

183. Studies on Avian type tuberculosis. III. Effect of streptomycin on YERSIN type tuberculosis in rabbits. Shutaro YAMAMOTO, Kiichi ISHIDA and Kosaku FUJIWARA (Transac. Soc. Path. Japan **40**, Edit. Reg. 39-40, 1951)

The authors previously reported a serial observation of YERSIN type tuberculosis, which produced in rabbits following intravenous inoculation of high virulent avian tubercle bacilli. The authors will describe in this report the effects of streptomycin on this acute, septicaemic type of experimental avian tuberculosis. All animals were examined histo-pathologically and quantitative culture from main organs and blood were performed. 11 rabbits received intravenous injection of 0.1 mg. per kilo. of Flamingo strain, a high virulent strain of avian tubercle bacilli. 7 animals out of 11 were treated with Dihydro-Streptomycin MERK from the 10th day or 12th day of the disease after the attack of fever was confirmed. Dosage of streptomycin was 0.1 gram for a day. Another 4 rabbits were reserved untreated as control animals. The control animals died 19, 24, 31 and 55 days after the inoculation, and the former three were typical YERSIN type tuberculosis. Duration of treatment was about 30 days and at the end of this period 4 animals were still living. Another three died during the period of treatment.

The first animal was unfortunately in pregnancy and died after a 5 days' treatment (total amount of streptomycin used being 0.5 g.), showing the characteristics of YERSIN type tuberculosis. The second animal died after a 16 days' treatment and both bacteriaemia and the growth of bacilli in the organs were strongly inhibited. Postmortem examination revealed cirrhosis of liver and at histopathological examination a marked dilatation of bile capillary with thickening of arginophilic fibres was observed around GLISSON's sheath. Large mononuclear cells in typhom-like lesions were dissociated each other. The third rabbit which died after a 25 days' treatment showed more advanced lesions than the second one and bacteriemia and the amount of bacilli in the organs were also somewhat larger. One of the 4 animals which survived the period of treatment was sacrificed 64 days after the inoculation. This animal showed regressive changes such as infiltration of lymphocytes and formation of giant cells in the liver and spleen. The amount of bacilli in the organs were far more smaller than the control animals. Another two rabbits died after 149 and 225 days' lapses under lumbar paralysis. Lesions of the joint appeared in these animals and lung lesions increase in size and number. The amount of bacilli in the lung, kidneys and adrenal relatively increased, so that the bacillary distribution was characteristic of VILLEMIN type tuberculosis. Bacteriemia again appeared near the death of animals.

The remaining one is still living though highly emaciated at the period of 230 days.

A marked swelling of the spleen such as YERSIN type tuberculosis was not seen in streptomycin-treated animals except for a pregnant animal. The average weight of the spleens of control animals was 8.5 g., while in the treated group it was only 3.9 grams.

Bacteriemia and multiplication of bacilli in the organs were markedly inhibited in the treated animals, while in the animals which died or were sacrificed after a prolonged period the distribution of the lesions and bacilli showed characteristics of VILLEMIN type tuberculosis.

As the conclusion, streptomycin treatment lead YERSIN type to chronic VILLEMIN type tuberculosis, yet the dorsage used here was not enough to sweep away the bacilli from the animal body.

184. Studies on Avian type tuberculosis. IV. Effect of sensitization on YERSIN type tuberculosis in rabbits. Shutaro YAMAMOTO, Kiichi ISHIDA and Kosaku FUJIWARA (Transac. Soc. Path. Japan **41**, Edit. Gen. 382-384, 1952)

There are striking differences in the distribution of lesions between YERSIN and VILLEMIN type tuberculosis. The rabbits which receive intravenous inoculation of larger dosage of high virulent avian tubercle bacilli, die about 4 weeks after an inoculation from septicaemic disease called YERSIN type, showing a marked swelling of spleen and liver. There are no tubercle formation in the naked eyes, but at the histopathological examination liver and spleen are highly affected, while the lung and kidneys are only slightly involved. The bacilli are also abundant in the liver, spleen and bone marrow, and far smaller in the lung and kidneys.

When the rabbits survived more than 10 weeks after intravenous inoculation of smaller dosage, tubercle formation occurs in various organs and, this time, the lung and kidneys are most severely involved. The bacilli are demonstrated almost in an equal amount in the liver, spleen, lung and kidney or they are dominant in the lung and kidneys.

THOMAS observed similar phenomenon in experimental bovine tuberculosis in rabbits and he called this "Diphasic nature of Tuberculosis". LURIE made an attempt to explain this phenomenon by serial observation on quantitative culture of the bacilli and found that the bacilli in the liver and spleen multiply rapidly and reach the maximum point at 4th week and then decrease, while in the lung and kidney the bacilli continue to grow slow but steadily.

The authors also pay attention to the "Diphasic nature" of experimental avian tuberculosis in rabbits, namely YERSIN and VILLEMIN type of the disease. Intradermal injection of avian tuberculin gives a positive reaction in VILLEMIN type tuberculosis, while in YERSIN type of the disease, rabbits die without showing a macroscopically positive reaction. Therefore, this time the authors performed an experiment whether the distribution of the lesions and bacilli can be modified in the course of YERSIN type tuberculosis by sensitization of animals prior to the inoculation.

Rabbits which received subcutaneous injection of low virulent avian tubercle bacilli, were inoculated intravenously with 0.05 mg. per kilo. of high virulent avian tubercle bacilli after various periods of from 1 week to 4 weeks and also at the same time.

All rabbits received intravenous inoculation at one time, and intradermal tuber-

culin reaction was examined immediately before reinfection. A distinct positive reaction was obtained in rabbits examined 2 to 4 weeks after sensitization.

The effect of the sensitization on the quantitative culture of the organs was observed even in a rabbit from the 1 week group, showing VILLEMIN type distribution of the bacilli. Another rabbit from the 1 week group survived 69 days and one rabbit from the 2 week group was sacrificed 42 days after reinfection. These two animals showed typical VILLEMIN type both in pathological changes and distribution of the bacilli. One rabbit from the 3 week group survived a very long time and died 211 days after intravenous inoculation, showing chronic VILLEMIN type with lesions of the joint. 3 animals died from diarrhoea within 8 days and no fluctuation from the course of YERSIN type was observed both in pathological researches and the distribution of the bacilli, independent of the period of sensitization. Two rabbits which received intravenous and subcutaneous inoculation at one time died 22 days and 36 days after inoculation respectively. Distribution of the bacilli in the former one resembled VILLEMIN type and there were confined lesions in the lung. The other showed the characteristics of YERSIN type tuberculosis.

A supplimental study was made with 4 rabbits, which previously received subcutaneous inoculation of low virulent avian tubercle bacilli. Three weeks after that intravenous injection of high virulent strain with dosage of 0.1 mg. per kilo. was made.

One animal was sacrified 14 days after reinfection. Lesions in this animal were well circumscribed and distribution of bacilli resembled VILLEMIN type. Two animals died 19 days and 24 days after reinfection respectively. The distribution of the bacilli in these two animals also resembled that of VILLEMIN type, but the histopathological changes were of intensified YERSIN type or the mixture of YERSIN and VILLEMIN types.

Remaining one was sacrificed 28 days after reinoculation, together with the death of the control animal. The involvement of the liver of this animal was slight and there were tubercle formation in the lung and kidney. The distribution of the bacilli resembled closely that of VILLEMIN type.

As the conclusion, the autohrs examined the effect of sensitization on YERSIN type tuberculosis and found that the sensitization by subcuaneous inoculation with low virulent aviant tubercle bacilli lead the course of YERSIN type somewhat to VILLEMIN type tuberculosis even in the period of YERSIN type tuberculosis.